US Army Corps
of Engineers
Mobile District

ALABAMA-COOSA RIVER BASIN WATER CONTROL MANUAL

APPENDIX G

ROBERT F. HENRY LOCK AND DAM

ALABAMA RIVER, ALABAMA

SEPTEMBER 1974
REVISED MARCH 1999

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Alabama River, Alabama

NOTICE TO USERS OF THIS MANUAL

Regulations specify that this Water Control Manual be published in loose-leaf form, and only those sections, or parts thereof, requiring changes will be revised and reprinted. Therefore, this copy should be preserved in good condition so that inserts can be made to keep the manual current.

EMERGENCY REGULATION ASSISTANCE PROCEDURES

If unusual conditions arise, contact --

Water Management Section
Mobile District Office
(334) 690-2737
(334) 479-0787 (non-duty hours)

Robert F. Henry Lock Foreman
(334) 872-9525
(334) 872-6490 (non-duty hours)

UNIT CONVERSION

This manual uses the U. S. Customary System (USCS) of units. Exhibit B contains a conversion table that can be used to convert USCS units to the metric system of units.

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R. F. HENRY LOCK AND DAM
ALABAMA RIVER, ALABAMA

PERTINENT DATA

GENERAL	
Dam site location	
State	Alabama
County	Autauga
River	Alabama
Miles above mouth of Alabama River	245.40
Total drainage area above dam site	
Square miles	16,300
1 inch of runoff equals, acre-ft	869,333
PHYSICAL COMPONENTS	
SPILLWAY	
Type	concrete-gravity
Total length, including end piers, feet	646
Net length, feet	550
Elevation of crest, feet above msl	91.0
Type of gates	tainter
Number of gates	11
Length of gates, feet	50
Height of gates, feet	35
Maximum discharge capacity (pool elev. 125.0), cfs	124,500
Elevation of top of gates in closed position, feet above msl	126.0
POWERHOUSE	
Type of powerhouse construction	reinforced concrete
Maximum power pool elevation, feet above msl	126.0
Maximum normal drawdown elevation, feet	123.0
Temporary/Emergency drawdown elevation, feet	122.0
Maximum static head, feet	47
Average operating head without spillway discharge, feet	29
Minimum head for generation, feet	15.3
Length of powerhouse, feet	375
Width of powerhouse including intake structure, feet	160
Number of units	4
Maximum discharge per unit, cfs	8,800
Generator capacity, MW	25
RESERVOIR	
Normal pool elevation, feet above msl	125.0
Maximum operating pool elevation, feet above msl	126.0
Minimum operating pool elevation, feet above msl	123.0
Area at pool elevation 125.0, acres	12,510

Area acquired in fee simple, acres	4,469
Area acquired by easement, acres	20,000
Area cleared, acres	6,050
Maximum elevation of clearing, feet above msl	130.0
Total volume to elevation 125.0, acre-feet	234,200
Length at elevation 125.0, miles	80.5
Shoreline distance at elevation 125.0, miles	368

LOCK

Nominal size of chamber, feet	84 x 600
Maximum lift, feet	47.0
Type of emergency dams	stop logs
Elevation of top of upstream emergency dam, feet above msl	126.7
Elevation of top of downstream emergency dam, feet above msl	97.9

EARTH OVERFLOW DIKES

Right Bank Dike

Total length, feet	2,661
Top elevation, feet above msl	135.0
Top width, feet	32

Left Bank Dike

Total length including lock mound, feet	12,639
Top elevation, feet above msl	143.0
Top width, feet	32

I - INTRODUCTION

1-01. **Authorization**. This water control manual was authorized by ER 1110-2-240 and EM 1110-2-3600, paragraphs 9-01 through 9-04. This manual also contains a drought contingency plan as designated by ER 1110-2-1941. EC 1110-2-8156 dated 31 August 1995 was used as a guide for the format of this manual.

1-02. **Purpose and Scope**. The primary purpose of this manual is to document the water control plan for the Robert F. Henry Lock and Dam project. Details of the coordinated reservoir regulation plan for Robert F. Henry Lock and Dam within the multiple project system of the Alabama River are presented which insure optimum benefits consistent with the physical characteristics and purposes for which the system was authorized. Included are descriptions of physical components of the lock and dam, operating procedures, historical facts, and other pertinent data. Also presented are general characteristics of the area including flood frequencies, meteorology, examples of reservoir regulation, and a discussion on river forecasting. This manual also serves as a reference source for higher authority and for new personnel who will become concerned with, or responsible for, regulation of the project.

1-03. **Related Manuals and Reports**. The "Alabama-Coosa River Basin Water Control Manual", of which this is Appendix G, contains general information for the entire basin. In addition, an "Operation and Maintenance Manual" and Emergency Notification Procedures, CESAM Plan 500-1-4 have been prepared for Robert F. Henry Lock and Dam.

1-04. **Project Owner**. The Robert F. Henry Lock and Dam project is a federally owned project entrusted to the U. S. Army Corps of Engineers.

1-05. **Operating Agency**. The U. S. Army Corps of Engineers Mobile District operates the Robert F. Henry Lock and Dam project. Reservoir operation and maintenance are under the supervision of Operations Division. The project falls under the direction of the Operations Project Manager located at Tuscaloosa, Alabama. Personnel attend the Robert F. Henry powerhouse from 6:30 AM to 2:30 PM each day. The phone number is 334-875-4400 during duty hours. Operators at the Millers Ferry Lock and Dam project perform powerhouse controls via remote control. The Millers Ferry powerhouse can be called at 334-682-9124. The lock is tended from 6 AM to 2 PM and from 6 PM to 2 AM by operators under the direct supervision of a lockmaster. The office phone number of the lock is 334-872-9525.

1-06. **Regulating Agencies**. The U. S. Army Corps of Engineers Mobile District regulates the Robert F. Henry Lock and Dam project. The Water Management Section in the Engineering Division monitors the project for compliance with the approved water control plan and makes operational decisions based upon that plan. When necessary, the Water Management Section instructs the powerhouse operators and lockmaster regarding normal procedures and emergencies for unusual circumstances.

II - DESCRIPTION OF PROJECT

2-01. **Location**. The Robert F. Henry Lock and Dam project is located in the south central part of the State of Alabama on the Alabama River at a point 245.4 miles above its mouth. It is approximately 15 miles east-southeast of Selma and 35 miles west of Montgomery. The dam and the first 32.9 miles of the R. E. "Bob" Woodruff Lake are in Autauga County, which is along the right side of the river, and Lowndes County, which is along the left side of the river. For the next 9.7 miles the right side of the lake is still in Autauga County but the left side is in Montgomery County. The remainder of the lake is in Elmore County on the right side and Montgomery County on the left side. The location of the project is shown on Plate 2-1.

2-02. **Purpose**. Robert F. Henry Lock and Dam is a multiple purpose project. The River and Harbor Act of 1945, Public Law 79-14, authorized flood control, navigation, and hydropower. The operating purposes include navigation and hydropower. There is no flood control storage in this project; flood control was deleted from the project plan prior to construction. The Flood Control Act of 1944, Public Law 78-854, authorized recreation. Access and facilities are provided for recreation, but water is not normally controlled for that purpose.

2-03. **Physical Components**. The Robert F. Henry project consists of a gravity-type dam with gated spillway supplemented by earth dikes, a navigation lock and control station, and an 82,000 kW power plant. At normal pool elevation 125.0 the reservoir formed by the dam extends upstream a maximum distance of 80.5 miles to Wetumpka on the Coosa River. Principal features of the project are described in detail in subsequent paragraphs. Sections, plan, and elevations of the dam and other features are shown on Plates 2-2 and 2-3.

a. **Spillway**. The spillway is a concrete-gravity structure equipped with 11 tainter gates 50 feet long and 35 feet high. The gate adjacent to the powerhouse is equipped with a trash gate that accommodates the passing of trash accumulations at the powerhouse and spillway. The spillway crest is at elevation 91.0. The top of gates in the closed position is elevation 126.0, which provides a l-foot freeboard above normal pool elevation 125.0. The overall spillway length is 646 feet. The net length is 550 feet. The gates are mounted between 8-foot wide piers and are operated by individual hydraulically operated ratchet gear hoists that are located on top of the piers. A bridge for pedestrian traffic spans the top of the piers. The spillway joins the lock abutment on the left side and the powerhouse on the right side. The spillway stilling basin is a horizontal concrete apron with a 5-foot high sloping end sill. The basin extends downstream a maximum distance of 100 feet from the spillway gate seal, and the apron is stepped in a transverse direction from elevation 73.0 down to elevation 63.0.

b. **Reservoir**. The Robert F. Henry Dam forms R. E. "Bob" Woodruff Lake, which covers an area of 12,510 acres at pool elevation 125.0. The impounded water at pool elevation 125.0 has a total volume of 234,200 acre-feet. The maximum length of the

reservoir at elevation 125.0 is 80.5 miles which consists of 69.0 miles up the Alabama River to its beginning; then, up the Coosa River 11.5 miles to Wetumpka. The lake at elevation 125.0 also extends to the tailrace of the Alabama Power Company's Walter Bouldin Dam that is located in a canal which runs from Jordan Lake to the Coosa River below Wetumpka. The reservoir also extends approximately 10 miles up the Tallapoosa River. Area and capacity curves are shown on Plate 2-4, and selected area and capacity values are tabulated on Table 2-1.

TABLE 2-1
R. E. "BOB" WOODRUFF LAKE
AREA AND CAPACITY

POOL ELEV. (MSL)	TOTAL AREA (ACRES)	TOTAL STORAGE (AC-FT)		POOL ELEV. (MSL)	TOTAL AREA (ACRES)	TOTAL STORAGE (AC-FT)
64	0	0		[2]122	10,470	200,030
65	10	10		[3]123	10,990	210,760
70	80	200		124	11,700	222,100
75	240	970		[4]125	12,510	234,210
80	600	2,970		[5]126	13,500	247,210
85	1,280	7,550		127	14,580	261,250
90	2,150	16,140		128	15,640	276,360
[1]91	2,320	18,370		129	16,650	292,510
95	2,970	28,590		130	17,730	309,700
100	3,900	46,040		131	19,150	328,140
105	5,260	68,880		132	20,550	347,990
110	6,660	98,740		133	22,300	369,410
115	8,110	135,700		134	24,050	392,590
116	8,400	143,950		[6]135	26,380	417,800
117	8,690	152,500		136	28,800	445,390
118	9,000	161,340		137	31,500	475,470
119	9,310	170,500		138	33,700	507,990
120	9,630	179,970		139	36,000	542,840
121	10,010	189,790		140	38,400	580,040

[1] Spillway crest
[2] Emergency drawdown elevation
[3] Maximum allowable drawdown
[4] Normal operating pool elevation
[5] Top-of-gates - closed position
[6] Crest of free overflow dike

c. **Earth dikes**. The earth dike on the right overbank is 2,661 feet long and connects the powerhouse with high ground to the northwest. A roadway along the dike provides access to the powerhouse. The top of the dike is at elevation 135.0 except the portion which slopes upward to the level of the switchyard at elevation 143.0. Floods of sufficient magnitude to overtop the dike have a recurrence frequency of once in 9 years. Both the upstream and downstream slopes of the dike are protected with grouted riprap against high velocities that occur during overtopping. The dike on the left overbank is a

non-overflow section with a top elevation of 143.0 and has an access road along its entire length. Considering the distance across the lock esplanade and an adjacent spoil area as part of the dike the total length is 12,639 feet. The top elevation of 143.0 is slightly above the computed headwater elevation of the standard project flood series. No riprap is provided on the slopes of this dike since the base is above the normal pool level, elevation 125.0.

d. **Lock**. The lock is located in the left bank between the spillway and the left overbank earth dike. The lock chamber is 84 feet wide and is 655 feet long between gate pintles. The usable length is slightly over 600 feet. The top of the upper gate blocks and the top of the upstream miter gate are at elevation 143.0. The top of all other walls and the downstream miter gate are at elevation 132.0. The top of the upper miter sill is at elevation 109.0, 16 feet below the normal upper pool elevation 125.0. The top of the lower miter sill is at elevation 67.0, 13 feet below the Millers Ferry normal pool elevation 80.0. The lock filling and emptying system is similar to that at Millers Ferry. It consists of two intake ports in the riverside face of the upper gate block, a longitudinal culvert in each of the chamber walls, a system of floor culvert in the chamber, and a discharge system that empties outside the lower approach. Reverse-tainter valves control flow in the culverts. The volume of water discharged in one-hour cfs for each time the lock is emptied can be determined by multiplying the gross head by 15.3.

e. **Lock-control station**. The control station is located between the spillway and lock adjacent to the upper gate block of the lock. The building is of reinforced concrete construction three stories high. It contains an office and the mechanical and electrical equipment necessary for operation of the lock and spillway. The third floor provides access to the spillway bridge.

f. **Powerhouse**. The powerhouse at the R. F. Henry Dam retained its original name as the Jones Bluff powerhouse. It is situated in the right bank of the river adjoining the switchyard and parking area mound to the west. It joins the end of the spillway section to the east or river-side. The building is a reinforced concrete structure, 375 feet long and 160 feet wide. It consists of 4 generation bays and one erection bay. The generation bays each contain a fixed-blade propeller-type turbine rated at 23,480 horsepower at a head of 28.2 feet. The turbine is connected to a vertical-shaft generator rated at 20,500 kilowatts. The intake is an integral part of the powerhouse structure and is positioned on the axis of the spillway.

g. **Switchyard**. The switchyard is located on the west side of the powerhouse which is the right bank of the river. It is joined on the west by the right overbank dike. The top elevation of the switchyard mound is 143.0. The principle structure in the switchyard is the main takeoff for the outgoing lines. There are other structures for busses, disconnecting switches, and potential transformers.

h. **Other facilities**. There are two houses located on the lock mound. They are leased to the Alabama Marine Police for an office and training facility.

2-04. **Real Estate Acquisition**. Acquisition guide lines were based upon backwater computations with the limit of taking being established at the elevation where the backwater effect with the dam in place is less than one foot. The profiles were developed using flows from 75,000 cfs to 125,400 cfs. The highest flows were for a natural recurrence frequency of once every 1.5 years. The guide taking line thus adopted begins at elevation 127.0 at the dam, mile 245.4, and continues at that elevation to mile 251.5; then on a uniform slope to elevation 130.5 at mile 264.0; then to elevation 131.0 at mile 271.0; and then to elevation 139.5 at mile 314.4, the junction of the Coosa and Tallapoosa Rivers. The actual taking line as developed through routine real estate practice is shown on Plates 2-5 and 2-6. The total area encompassed by the taking line is 18,845 acres, of which 5,370 acres were purchased in fee for construction and public use areas. Flowage easements were acquired on the remaining 13,475 acres.

2-05. **Public Facilities**. R. E. "Bob" Woodruff Lake, impounded by Robert F. Henry Lock and Dam, greatly enhances the opportunities for water-oriented recreation. The lake offers such activities as fishing, boating, water skiing, picnicking, camping, swimming, and hiking. The project features 17 primary recreation facilities that are rustic but well facilitated for visitors. Fifteen of the sites are operated by the Corps and have approximately 3,978 total acres. The Fort Toulouse National Historic Park is State operated and maintained and has approximately 183 total acres. Powder Magazine is operated by the City of Montgomery and has approximately 58 total acres. Conveniences at the parks include beaches, campgrounds, picnic areas, trails, and boat launching ramps. Since the first park was constructed in 1975, annual attendance has risen to over 2 million. All public use areas are shown on Plate 2-7. The phone number for the Robert F. Henry Site Office is 334-872-8210.

III - HISTORY OF PROJECT

3-01. **Authorization**. The original project for the improvement of the Alabama River was authorized by Congress on 18 June 1878 to provide for a navigation channel 4 feet deep and 200 feet wide from the mouth to Wetumpka and was modified on 13 July 1892 to provide a 6-foot channel. Subsequent acts approved in 1905 and 1910 provided for a channel 4 feet deep at low water from the mouth to Wetumpka by the use of contracting dikes and dredging. This project was 62 percent complete in 1942, the last year that any new work was performed. The authorization of a modified plan of development in 1945 replaced the project entirely.

3-02. **Planning and Design**.

a. The first comprehensive plan for the optimum use of the water resources of the Alabama-Coosa basin was developed by the Corps of Engineers under the authority of House Document No. 308, 69th Congress and was published in November 1934 as House Document No. 66, 74th Congress, 1st Session. The plan contemplated five navigation dams on the Alabama River.

b. A resolution of the Committee on Rivers and Harbors, House of Representatives, passed on 28 April 1936 requested that a review be made to determine if changes in economic conditions might warrant modification of the recommendations in House Document No. 66, 74th Congress, with regard to the Alabama River. A resolution of the Committee on Commerce, U. S. Senate, adopted 18 January 1939 requested a review to determine the advisability of constructing reservoirs on the Alabama-Coosa Rivers and tributaries for development of hydroelectric power and improvement for navigation

c. The Chief of Engineers in a report submitted on 15 October 1941 and printed as House Document No. 414, 77th Congress, 1st Session recommended a general plan for the development of the basin. Congress authorized in the River and Harbor Act of 2 March 1945 (Public Law 14, 79th Congress) the initial and partial accomplishment of this plan. Planning studies for the initially authorized projects on the Alabama River to provide navigation facilities with the maximum hydroelectric power feasible began in 1945.

d. A site selection report for the entire Alabama River was submitted on l0 December 1945 which determined that the overall project for the Alabama River should consist of dredging in the lower river, and navigation dams and locks at Claiborne, Millers Ferry and Jones Bluff upstream with power plants added to the latter two projects. The first design memorandum for Jones Bluff presenting "Basic Hydrology" was submitted on 30 April 1963. It was followed by the "General Design" on 16 March 1964 and then by 19 design memoranda for particular features of the project during the next eight years.

3-03. **Construction**.

a. The first phase of construction placed under contract at the Robert F. Henry project was the lock excavation, which commenced on 7 February 1966, and was completed on 1 October 1966. No other work was contracted because of delays in funding until 1968. The Dravo Corporation was awarded a contract for construction of the lock, 9 gate-bays of the spillway, the earth overbank dikes, the access roads, and the lock mound on 17 April 1968. The work under that contract was completed 15 October 1971 at a total cost of $16,417,377.38.

b. The second-stage cofferdam was completed in October 1970 which closed the river channel. The reservoir was not filled at the time because of reservoir clearing operations under way in the lower reaches. The river flow was passed through the gate bays in the completed portion of the spillway. In November 1971 filling was begun in conjunction with clearing operations in the upper reaches of the reservoir. When clearing was completed in December 1971 the reservoir was filled to normal pool elevation 125.0. The first navigation through the lock was allowed in January 1972 and the facility was officially opened to navigation on 15 April 1972.

c. A contract for construction of the powerhouse and the last two gate bays of the spillway was awarded on 23 June 1972 to Peter Kiewlt and Sons along with Standard Construction Company as a joint venture. The power units were placed in operation in 1975 at approximately three month intervals for each unit.

d. Spillway Gate No. 1 was modified in 1990 to include a trashgate which accommodates the passing of trash accumulations at the powerhouse and spillway.

3-04. **Project Designation**.

a. The reservoir has been designated the R. E. “Bob” Woodruff Lake.

b. Public Law 97-383 [S. 2034]; December 22, 1982, designated “the lock and dam known as the Jones Bluff Lock and Dam, located on the Alabama River, as the ‘Robert F. Henry Lock and Dam’.” The powerhouse has retained its original name as the Jones Bluff powerhouse.

3-05. **Related Projects**. The Robert F. Henry Lock and Dam project is the third major unit of the navigation system developed on the Alabama River by the U. S. Army Corps of Engineers. Millers Ferry Lock and Dam, located downstream at navigation mile 178.0 above the foot of Government Street, Mobile, Alabama, also has hydropower capability. Claiborne Lock and Dam is located downstream of Millers Ferry at navigation mile 117.5 above the foot of Government Street, Mobile.

IV - WATERSHED CHARACTERISTICS

4-01. **General Description of Basin**. The Alabama-Coosa River system drains a small portion of Tennessee, northwestern Georgia, and northeastern and east-central Alabama. The Alabama River basin has its source in the Blue Ridge Mountains of northwest Georgia. The main headwater tributaries are the Oostanaula and Etowah Rivers, which join near Rome, Georgia, to form the Coosa River. The Coosa River in turn joins the Tallapoosa River near Wetumpka, Alabama, approximately 14 miles above Montgomery, Alabama, to form the Alabama River. The drainage basin is approximately 330 miles in length, and averages 70 miles wide with a maximum width of about 125 miles. The basin has a total drainage area of 22,500 square miles of which 16,300 square miles are above Robert F. Henry Lock and Dam. In the early 1990's the Alabama-Coosa River basin became more widely known as the Alabama-Coosa-Tallapoosa, or ACT, River basin. Plate 4-1 shows a map of the ACT River basin.

4-02. **Topography**. The ACT River basin is composed of an unusually wide range of topographic areas. The location of the river basin is within parts of five physiographic provinces: the Blue Ridge Province; the Valley and Ridge Province; the Piedmont Plateau; the Cumberland Plateau; and, the Coastal Plain. Each of these physiographic sub-divisions influences drainage patterns. High rounded mountains and steep narrow valleys characterize the northeastern portion of the basin in the Blue Ridge Province. Overburden is sparse except in the valley flood plains. The topography of the Valley and Ridge Province is alternating valleys and ridges with altitudes varying from approximately 600 to 1,600 feet. The dominant characteristics of the Cumberland Plateau are flat plateaus ranging in altitude from 1,500 to 1,800 feet that bound narrow, northeast-southwest trending valleys. Rolling hills and occasional low mountains topographically characterize the Piedmont Province. Altitudes range from 500 to 1,500 feet. Low hills with gentle slopes and broad shallow valleys that contain slow-moving meandering streams with wide flood plains characterize the topography of the Coastal Plain. The Alabama River flows through a broad lowland valley that varies in width from 3 to 10 miles throughout the length of the Robert F. Henry Lock and Dam project. To the south the river borders the Black Belt, a prairie land so named for its rich, black soil and flat to gently rolling prairie land developed over the Selma Chalk Formation. The northern side of the river is bounded by stable formations that are more resistant to erosion. Exposed hillsides with a greater relief is characteristic of this northern side. The river strikes a broad, meandering, westerly course through the valley falling at a rate of 0.5-foot per mile. Normal river elevation is below the flood plain. There are numerous tributaries entering the river from both sides and are rather evenly distributed between the upper and lower limits of the lake.

4-03. **Geology and Soils**. The ACT River basin covers an unusually wide range of geologic conditions. The location of the river basin is within parts of five physiographic provinces: the Blue Ridge Province; the Valley and Ridge Province; the Piedmont Plateau; the Cumberland Plateau; and, the Coastal Plain. Each of these physiographic sub-divisions influences drainage patterns. Rugged crystalline rocks characterize the northeastern portion of the basin in the Blue Ridge Province. Folded limestone, shale,

and sandstone compose the Valley and Ridge Province. The axes of the folds that trend northeast-southwest influence the course of the streams in that they tend to flow southwestward along the alignment of the geologic structure. Like the Valley and Ridge Province -- folded, faulted, and thrusted rocks form the Cumberland Plateau -- with the deformation being less than the Valley and Ridge rocks. The east-central portions of the basin are in the Piedmont Province, characterized by sequences of metamorphic and igneous rocks. Prominent topographic features generally reflect the erosional and weathering resistance of quartzite, amphibolite, and plutonic rocks. The residual soils are predominately red sandy clays and gray silty sand derived from the weathering of the underlying crystalline rocks. The more recent sedimentary formations of the Coastal Plain underlie the entire southern portion of both river basins. The contact between the Coastal Plain on the south and the previously described physiographic provinces to the north is along a line that crosses the Cahaba River near Centreville, Alabama; the Coosa River near Wetumpka, Alabama; and the Tallapoosa River near Tallassee, Alabama. As the rivers leave the hard rocks above this line and enter the softer formations of the Coastal Plain, the erosion properties change, resulting in the formation of rapids. This line is a geological divide commonly known as the "fall line". The rocks of the Coastal Plain are typically poorly consolidated marine sediments.

Overlying the bedrock at the Robert F. Henry Lock and Dam site are layers of fine and coarse grained soils that average 30 feet in thickness. The fine-grained soils consist of silty clay, silty sand and fat clay. The clays were deposited in depressions and range in thickness up to 25 feet. Below the fine grained soils is a layer of poorly graded sand and poorly graded gravel that averages 20 feet in thickness. Underlying the sand and gravel is a soft, residual layer of clay overlying bedrock that generally slopes towards the river channel.

Two geologic formations exist at the project. The Selma Chalk Formation comprises the upper rock section and ranges in thickness from 100 to 135 feet. The Selma Chalk Formation is composed of gray, calcareous chalk, siltstone and claystone with thin layers of green clay. The Eutaw Sand Formation underlies the Selma Formation and ranges in thickness up to 400 feet. The sand is fine to medium grained, green to gray, micaceous and fossiliferous. The Eutaw Formation contains groundwater under artesian pressure.

The geologic structure at the project is a monocline dipping about 35 feet per mile in a southwesterly direction. The Selma Chalk Formation thickens in the downstream direction and includes about 1000 feet of calcareous rocks at full thickness.

4-04. **Sedimentation**. Sedimentation ranges have been established for the entire length of the reservoir and their original profiles have been surveyed. Key ranges will be resurveyed at regular intervals in order to spot any appreciable changes from the original. The ranges were last resurveyed in September 1988. The range locations are shown on Plate 4-2. Plots of the original survey and resurvey for selected ranges are shown on Plate 4-3.

4-05. **Climate**.

a. **Temperature**. The average annual temperature in the vicinity of Robert F. Henry Lock and Dam is about 65° F. This figure is based on normal annual temperatures at Selma, Alabama, with 117 years of record, and Montgomery, Alabama, with 123 years of record. Extreme temperatures recorded at these stations have been a high of 108° and a low of -5°. The summer temperatures average about 81° and the winter about 48°.

b. **Precipitation**. The Alabama-Coosa-Tallapoosa River Basin lies in a region of heavy annual rainfall, which is fairly well distributed throughout the year. The normal annual precipitation is 55.06 inches, of which 57 percent occurs during the winter and spring, 23 percent in the summer and 20 percent in the fall. The normal monthly and annual precipitation over various portions of the Alabama-Coosa Basin above Robert F. Henry Dam are shown on Plate 4-4. The maximum annual rainfall over the basin was 78 inches in 1929 and the minimum annual was 32 inches in 1954. The highest annual station rainfall recorded in the basin was 104.03 inches at Flat Top, Georgia, in 1949. The lowest recorded rainfall was 22.00 inches at Primrose Farm, Alabama, in 1954. Moderate snowfall occurs in the northern portion of the basin during the winter months, but seldom covers the ground for more than a few days at a time and has not been an important contributing factor in any major flood.

4-06. **Storms and Floods**.

a. **General**. Flood-producing storms may occur over the basin anytime but are more frequent during the winter and early spring. These storms are usually of the frontal variety lasting two to four days. Summer storms are the convective type thundershowers with high intensity rainfall over small areas which produce local floods. In the fall, occasional heavy rains may accompany dissipating tropical cyclones.

b. **Record Floods**. A major storm system in the spring of 1990 produced record floods on the Alabama River. On March 16, 1990, with the river still high from previous rains, the entire basin received very heavy rainfall for two days. For the two day total Robert F. Henry reported 9 inches, Millers Ferry reported 6.75 inches and Claiborne had 9.5 inches. The upper basin received an average of 6 to 7 inches during this period. Robert F. Henry discharged a record-breaking 220,000-cfs on March 20, 1990 producing a record tailwater of 135.4 feet. The largest known flood for the entire period of record is the historical flood of February-March 1961 with a peak discharge of 283,200 cfs.

4-07. **Runoff Characteristics**. The tributaries contributing flow to the Alabama River above the Robert F. Henry damsite exhibit wide variations in runoff characteristics. They range from very flashy in the mountainous regions of the Coosa basin above Rome, Georgia, to very slow rising and falling in the lower reaches. The mean annual discharge for the period January 1929 through December 1993 is 26,771 cfs or about 1.5 cfs per square mile.

4-08. **Streamflow at Robert F. Henry Damsite**. The average daily discharges shown on Plates 4-5 through 4-9 and the mean monthly and annual flows on Plates 4-10 through

4-12 were developed from data for the USGS gage at Selma, AL and discharge data from the gage site.

4-09. **Water Quality**. Generally, the surface waters of the Alabama River Basin are of good chemical quality. Overall, the water quality of the R. E. "Bob" Woodruff Lake is adequate. Some tributaries to the lake, including Catoma Creek and Big Swamp Creek, as well as municipal, industrial, and agricultural discharges have a detrimental effect on the water quality of the lake. Typically, the water in the lake is low in dissolved oxygen; pH varies from 6 and 8; oxygen is sufficient to support a diverse fish fauna; and nitrogen and phosphorous concentrations are below levels likely to cause eutrophication.

4-10. **Channel and Floodway Characteristics**. The navigation channel from the mouth of the Alabama River to Montgomery, Alabama has an authorized depth of 9 feet and a width of 200 feet.

4-11. **Upstream Structures**. Above Robert F. Henry Lock and Dam are Alabama Power Company hydroelectric projects on the Coosa and Tallapoosa Rivers and two Corps projects, Allatoona and Carters, located above the APC Coosa projects. Table 4-1 shows the upstream projects and their drainage areas.

Table 4-1
Upstream Projects from Robert F. Henry Lock and Dam

Agency	Coosa Projects	Drainage Area sq. mi.	Agency	Tallapoosa Projects	Drainage Area sq. mi.
APC	Weiss	5,610	APC	Harris	1,453
APC	Henry	6,596	APC	Martin	2,984
APC	Logan Martin	7,743	APC	Yates	3,293
APC	Lay	9,053	APC	Thurlow	3,308
APC	Mitchell	9,778			
APC	Jordan/Bouldin*	10,102			
COE	Allatoona	1,117			
COE	Carters	373			

* Jordan Dam is located on the Coosa River at river mile 18.9. Walter Bouldin Dam is located on a by-pass of the Jordan Dam and discharges into a canal which enters the Woodruff Lake at Coosa River mile 4.2.

4-12. **Downstream Structures**. Below Robert F. Henry Lock and Dam are two Corps projects, Millers Ferry and Claiborne Locks and Dams. Millers Ferry has a drainage area of 4,400 square miles from Robert F. Henry to Millers Ferry. Claiborne has a drainage area of 820 square miles from Millers Ferry to Claiborne.

V - DATA COLLECTION AND COMMUNICATION NETWORKS

5-01. **Hydrometeorological Stations**.

a. **Facilities**. The hydrometeorological network installed in the Alabama River Basin facilitates the operation of Robert F. Henry and Millers Ferry for power generation. The Mobile District's daily hydrometeorological system for the Alabama-Coosa-Tallapoosa River basin includes 27 rainfall stations, 41 river stations and, flow data for 5 Corps projects and 4 Alabama Power projects. There are 20 river stage gages and 30 rainfall gages between Montgomery and the mouth of the Alabama River. The river stations and rainfall stations are listed in Tables 5-1 and 5-2 and shown on Plate 5-1. Discharge rating curves for the tailwater at Robert F. Henry L&D and for Catoma Creek near Montgomery, AL are shown on Plates 5-2 and 5-3.

Table 5-1
River Stage Gages Between Montgomery and Mouth of Alabama River

Location	Station No.	Stream	River Miles Above Mouth	Drainage Area (mi^2)	Gage Zero Elev. (NGVD)	Flood Stage	Servicing Agency
River Stage Gages in the Daily Hydrologic Network							
Montgomery	02420000	Alabama R.	287.6	15,087			USGS
Montgomery	02421000	Catoma Ck.	16.1	290	151.02	20	USGS
Robert F. Henry (HW)	02421350	Alabama R.	245.4	16,233	0.00		USGS
Robert F. Henry (TW)	02421351	Alabama R.	245.4	16,233	0.00	122	USGS
Selma	02423000	Alabama R.	214.8	17,095	61.8	45	
Centreville	02424000	Cahaba R.	81.2	1,027	180.74	23	USGS
Suttle	02424590	Cahaba R.	31.0	1,480	97.64		USGS
Marion Junction	02425000	Cahaba R.	21.4	1,766	86.72	36	USGS
Millers Ferry (HW)		Alabama R.	142.3	20,637	0.00		USGS
Millers Ferry (TW)	02427506	Alabama R.	142.3	20,637	0.00	66	USGS
Claiborne (HW)		Alabama R.	81.9	21,520	0.00		USGS
Claiborne (TW)	02428400	Alabama R.	81.8	21,520	0.00	42	USGS
Choctaw Bluff	02429593	Alabama R.	42.3				COE
Other River Stage Gages Within the Alabama River Basin							
Jones	02422500	Mulberry Ck.	11.0	203	165.23		USGS
Trussville	02423130	Cahaba R.	182.3	20	673.30		USGS
Mtn. Brook	02423380	Cahaba R.	153.6	140	443.85		USGS
Cahaba Hts.	02423425	Cahaba R.					USGS
Hoover	02423496	Cahaba R.	138.9	226	379.56		USGS
Acton	02423500	Cahaba R.	136.8	230	375.00		USGS
Snow Hill	02427250	Pine Barren Ck.	4.0	261	126.60		USGS

TABLE 5-2
Rainfall Reporting Network
Between Montgomery, AL and Robert F. Henry Lock and Dam

Station	Latitude	Longitude	Elevation (Ft. ngvd)	Type	Agency(1)
Alabama River above Robert F. Henry Dam					
Billingsley	32° 40	86° 40	445	Non-rec	NWS
Mathews	32° 16’	86° 00’	190	Non-rec	NWS
Montgomery WSO*	32° 18’	86° 24’	221	Recording	NWS
Catoma Creek*	32° 18’	86° 17’	151	Recording	Corps of Engineers
Autaugaville 3N	32° 28’	86° 41’	200	Non-rec.	NWS
R. F. Henry L&D*	32° 19’	86° 47’	146	Recording	Corps of Engineers
Alabama River - Robert F. Henry Dam to Millers Ferry Dam					
Plantersville 2SSE	32° 37’	86° 54’	230	Non-rec.	NWS
Selma*	32° 25’	87° 00’	147	Non-rec.	NWS
Palmerdale	33° 46’	86° 39’	720	Non-rec.	NWS
Pinson	33° 41’	86° 42’	608	Non-rec.	NWS
Cahaba Heights	33° 27’	86° 43’	461	Non-rec.	NWS
Oak Mtn St.Park 2N	33° 24’	86° 42’	660	Non-rec.	NWS
Helena	33° 16’	86° 50’	480	Non-rec.	NWS
Calera	33° 06’	86° 45’	530	Non-rec.	NWS
Montevallo	33° 06’	86° 52’	410	Non-rec.	NWS
West Blocton	33° 07’	87° 07’	500	Non-rec.	NWS
Centreville WSMO*	32° 54’	87° 15’	456	Non-rec.	NWS
Marion 7 NE	32° 42’	87° 16’	172	Recording	NWS
Perryville	32° 36’	87° 09’	500	Non-rec.	NWS
Suttle*	32° 32’	87° 11’	145	Non-rec.	NWS
Marion Junction 2NE*	32° 28’	87° 13’	200	Non-rec.	NWS
Millers Ferry L&D*	32° 06’	87° 25’	115	Recording	NWS
Uniontown	32° 27’	87° 31’	280	Non-rec.	NWS
Alberta	32° 14’	87° 25’	175	Recording	NWS
Camden 3 NW	32° 02’	87° 19’	235	Non-rec.	NWS
Pine Apple	31° 52’	86° 59’	250	Non-rec.	NWS
Alabama River - Millers Ferry Dam to Claiborne Dam					
Thomasville	31° 55’	87° 44’	405	Recording	NWS
Whatley	31° 39’	87° 43’	170	Non-rec.	NWS
Robert F. Henry L&D*	31° 37’	87° 33’	50	Recording	Corps of Engineers
Frisco City 3SSW	31° 23’	87° 25’	275	Non-rec.	NWS

***Included in the MDO’s Daily Hydrologic Network (1) NWS - National Weather Service**

b. **Reporting**. Automatic radio reporting river stage gages are interrogated at Millers Ferry. This data and all station reports for Robert F. Henry, Millers Ferry and Claiborne are relayed to the Water Management Section by computer. The Water

Management Section's computer interrogates the Catoma Creek, Suttle, and Choctaw Bluff gages collecting and storing river stages daily. The Montgomery gage and Selma gage are extracted from the National Weather Service by computer. The river stage data can be obtained from the annual report titled "Water Resource Data Alabama" published by the U. S. Geological Survey. Rainfall reports from the stations at Robert F. Henry and Millers Ferry are relayed to the Water Management Section from Millers Ferry powerhouse personnel by computer network, facsimile, or telephone. The radio reporting stations are monitored at Millers Ferry and the data is transferred to the Water Management Section. Observers at non-recording stations report rainfall readings to the National Weather Service according to the NWS Reporting Instructions shown on Plate 5-4, and the data is relayed to the Water Management Section. The airways stations at Montgomery and Selma report every 6 hours. Robert F. Henry and Millers Ferry report every 6 hours. The rainfall totals are documented by the National Weather Service in a monthly publication titled "Climatological Data Alabama."

c. **Maintenance**. The Corps of Engineers, Mobile District has a cooperative program with the U. S. Geological Survey and their office in Montgomery, Alabama for both maintenance and the exchange of data for the gages identified in the above paragraphs. Maintenance of the gages is accomplished by each agency maintaining the gages they are responsible for according to the program.

5-02. **Water Quality Stations**. Water quality measurements are made at 14 USGS gaging stations within the Alabama River basin. The data for these stations can be obtained from the USGS yearly publication, ***Water Resources Data Alabama*** and ***Water Resources Data Georgia***. The Corps of Engineers operates a continuous water quality station located below Robert F. Henry Lock and Dam. The parameters monitored are dissolved oxygen, pH, conductivity, and temperature.

5-03. **Recording Hydrologic Data**. The Water Management Section maintains a Data Storage System, DSS, containing various hydrologic data from the different projects and river basins within the Mobile District. For the ACT River Basin this database includes data from various river gage locations and rainfall locations as well as data relative to the water control operations at Robert F. Henry. The data is input into the database either automatically via computer program or manually by entering the data.

Stream flow measurements have been made at the river gages within the ACT Basin. Records for these stations are published annually by the US Geological Survey. Data is also available through the Water Management Section computer database as well as the USGS Prime computer database.

5-04. **Communication Network**. The primary communication network consists of the commercial telephone network, the South Atlantic Division Regional Village computer network, and a two-way radio system. The radio system is part of the District's radio communication network.

5-05. **Communication With Project**.

a. **Regulating Office with Project Office**. Communication between the Water Management Section and Robert F. Henry Lock and Dam is by commercial telephone and computer network. The Water Management Section can transfer current data files from the Millers Ferry computer at any time using File Transfer Protocol, FTP. During emergencies, a two-way voice radio in the Readiness Branch of Operations Division can be used. For powerhouse and spillway operations, communication is between Water Management Section and powerhouse operating personnel at Millers Ferry. Millers Ferry communicates with Robert F. Henry lock tenders by a fixed station VHF radio network which is part of the Mobile District's radio communication network. The equipment is located in the powerhouse and the lock control office at both projects. There are also a varying number of mobile units for local communication in the reservoir area.

b. **Between Project Office and Others**. The Water Management Section communicates daily with the National Weather Service and Alabama Power Company to exchange data and forecasting information. The data exchange is made by computer and is supplemented by telephone and facsimile when necessary. The Water Management Section also has a computer link with the National Weather Service's AFOS communication system via the River Forecast Center in Atlanta, Georgia. The Water Management Section, Millers Ferry, and Claiborne all use a telephone auto-answer recorded message to provide daily information to the public.

5-06. **Project Reporting Instructions**. Millers Ferry powerhouse personnel input project data into their computer every hour. The information includes rainfall, pool elevations, and other information pertinent to effective water management at Robert F. Henry and Millers Ferry. The Water Management Section receives the project data every six hours by computer network using FTP.

5-07. **Warnings**. It is the responsibility of the National Weather Service to issue flood warnings to the general public. The Water Management Section will assist by providing current reservoir operation data to the NWS and by posting the river forecast on the internet homepage.

VI - HYDROLOGIC FORECASTS

6-01. **General**. The Robert F. Henry project is affected by the operation of the Alabama Power Company projects upstream. Therefore the Alabama Power Company, the National Weather Service, and the Corps of Engineers exchange data daily to provide quality forecasts on inflows, headwater elevations, tailwater elevations and river stages on the Alabama River.

a. **Role of Corps**. The Water Management Section obtains on a daily basis flow estimates for the Alabama Power Company projects. The Water Management Section considers these inflows, local flows, current pool levels, and discharge requirements in scheduling releases from Robert F. Henry and Millers Ferry Dams. The Water Management Section maintains close liaison with the National Weather Service's River Forecast Center and Birmingham offices at all times, particularly during floods, with mutual exchange of information and agreement on expected stages at NWS river stations which may be affected by operations at Corps of Engineers projects.

b. **Role of Other Agencies**. The National Weather Service has the legal responsibility of issuing stage forecasts to the general public. Forecasts for the Alabama River basin are prepared by the National Weather Service Southeast River Forecast Center in Atlanta, Georgia, and issued to the public through their Birmingham and Mobile, Alabama, offices. Table 6-1 lists the forecast stations in the Alabama River basin.

6-02 **Forecasting procedure**. The Water Management Section transmits the Alabama Power Company data to the River Forecast Center in Atlanta, Georgia, for them to use in constructing forecasts for Robert F. Henry, Millers Ferry, and Claiborne inflows along with their respective tailwater elevation and the river stage for Montgomery, Alabama, station #02419988. Additional stage forecasts are included during periods of high flows. The additional stage locations are listed in Table 6-1

Table 6-1
Southeast River Forecast Center Forecast Locations
for Alabama River Basin

Daily Stage/Elevation Forecasts				
	Station	**Station ID**	**Critical Stage**	**Flood Stage**
	Montgomery	MGMA1	26	35
	R. F. Henry TW	TYLA1		122
	Millers Ferry TW	MRFA1		66
	Claiborne TW	CLBA1	35	42
Daily 24-hour Inflow in 1000 SFD Forecast				
Reservoir		**Station ID**		
R. F. Henry		TYLA1		
Millers Ferry		MRFA1		
Additional Stage Forecasts Only for Significant Rises				
River/Creek	**Station**	**Station ID**	**Critical Stage**	**Flood Stage**
Coosa	Weiss Dam	CREA1		564
Coosa	Gadsden	GAPA1		511
Coosa	Logan Martin Dam	CCSA1		465
Coosa	Childersburg	CHLA1		402
Coosa	Wetumpka	WETA1	40	45
Tallapoosa	Wadley	WDLA1		13
Tallapoosa	Milstead	MILA1	15	40
Tallapoosa	Tallapoosa Wt Pit	MGYA1	15	25
Catoma Creek	Montgomery	CATA1	16	20
Alabama	Selma	SELA1	30	45
Cahaba	Cahaba Hts	CHGA1		14
Cahaba	Centreville	CKLA1	20	23
Cahaba	Suttle	SUTA1	28	32
Cahaba	Marion Junction	MNJA1	15	36

VII - WATER CONTROL PLAN

7-01. **General Objectives**. The primary function of the Robert F. Henry Lock and Dam project is to provide a navigable channel; therefore, the lake will be regulated at or near the approved normal pool of elevation 125.0 feet ngvd. The other major function of the project is hydroelectric power generation. Provision has been made for two feet of pondage below elevation 125.0 to facilitate operations for hydropower generation, navigation, and downstream minimum flow requirements. Fluctuations up to elevation 126.0, the top of the spillway gates, will be permitted for increased flow-regulating capability, power generating head, and other worthy purposes.

7-02. **Constraints**.

a. **Full Discharge Capacity**. The full discharge capacity of the spillway at elevation 125.0 is 124,500 cfs, the equivalent of a flood which may be expected to occur once in 1.5 years. Once the spillway capacity is reached a free overflow condition will prevail. There will be little difference in the water surface upstream and downstream of the dam. The river may continue to rise just as it would in the absence of any structure.

b. **Head limitation**. Design criteria for stability against overturning and sliding of the Robert F. Henry structures make it imperative that the head, or difference between headwater and tailwater, does not exceed 47 feet at any time. All operational planning has been based on this strict limitation.

7-03. **Overall Plan for Water Control**. The reservoir level will be maintained between elevations 124.0 and 126.0 by passing the inflow through the power plant and/or the spillway gates until the powerhouse becomes inoperative. Discharges above approximately 112,000 cfs will cause the power plant to be nonproductive because of the high tailwater, so that for higher flows no outflow will pass through the turbines. With turbines out of service, spillway gates will be opened to lower and maintain the pool between elevations 124.0 and 126.0. When the inflow exceeds approximately 125,000 cfs, the spillway capacity will be reached, and there will be no control over the outflow. At such high flow, there will be little difference in the water level above and below the dam, and the flow condition will be that of a natural river in flood. The gates will remain in the full open position until the pool peaks and recedes. As the pool level recedes, spillway gates will be lowered to maintain the elevation between 124.0 and 126.0. When the tailwater is sufficiently low to restart the powerhouse, the spillway gates will be lowered, and the power plant and spillway gates will be used to maintain the elevation between 124.0 and 126.0. Gate operating instructions are given in a subsequent paragraph. Any departures from this operating schedule will be made only as directed by the Water Management Section. Plate 7-1 shows total spillway and overbank discharge for pool levels above elevation 125.0. In periods when flow is less than powerhouse capability, peaking power releases will be made as described in paragraph 7-05. More detailed instructions for water control operations are given in the following paragraphs.

7-04. **Standing Instructions to Damtender**. Exhibit C, Standing Instructions to the Project Operator for Water Control, describes the operator's responsibilities considered

necessary for reservoir regulation. These duties include reservoir operating procedures, data collecting, and data reporting.

7-05. **Hydroelectric Power**. The Jones Bluff powerhouse at the project is operated as a run-of-river hydropower plant for the production of hydroelectric energy and capacity. Depending upon flow, the plant is either continuously running (high flow) or peaking (low flow) on a 7-day basis. The output from the plant is marketed by the Southeastern Power Administration (SEPA) in accordance with provisions in the Flood Control Act of 1944. The responsibility under this Act for determining the amount of power that can be produced from this project has been delegated to the Mobile District Engineer. The District Engineer relies on the Water Management Section to make weekly and daily determinations of hydropower that can be generated.

a. **Normal Operation**. Energy from the Robert F. Henry project is included in the weekly minimum contract requirements. Therefore, a 7 day declaration will be made each week. However, with 82 percent of the drainage area above the project controlled by the Alabama Power Company dams upstream and the short time of travel from these dams to Robert F. Henry it will not be possible for SEPA to make a definite schedule of power generation based on the weekly declaration. Normally, a declaration of energy and capacity available at the project is prepared each morning by the Water Management Section for the next day. The declaration, which is based on current pool levels, capacities, expected inflows, and discharge requirements, is then given to SEPA. Actual hourly scheduling will be as directed by SEPA in accordance with the declaration. There may be times when the Water Management Section will require generation during certain hours. When this condition exists, SEPA will be notified, and they will schedule generation only during these hours. Changes to the generation schedule will be made by 2 P.M. on the day prior to the day the change will be implemented whenever possible. Because of changes in discharge estimates at upstream projects, schedule changes may be made hourly or daily by the Water Management Section as required to maintain the lake within established operating levels. Performance curves which indicate the discharge capacity and power output capability at various operating heads for a single turbo-generator unit are shown on Plate 7-2.

b. **High-Flow Operation**. During periods when the reservoir inflow is equal to or greater than the capacity of the turbines, the power plant will be operated at full capacity around the clock. As the flow increases, rising tailwater elevations will reduce the head and the power output. When the head decreases to approximately 15.3 feet, the units will be shut down.

c. **Low-Flow Operation**. The hydropower operation during extended low flow or drought periods is slightly different from the normal operation. The maximum allowable drawdown is elevation 123.0. Provisions have been made for an emergency drawdown elevation of 122.0. During extended low-flow periods the Water Management Section will establish a target tailwater elevation at Claiborne Lock and Dam. The Section will schedule sufficient daily generation and discharge from Robert F. Henry and Millers Ferry to maintain the target tailwater elevation. If the generation schedule causes

the pool to drop to elevation 122.5, the Project Operator for water control will notify the Water Management Section. In no case will releases be made if the pool falls to elevation 122.0 unless specifically directed by the Water Control Manager. Because the upstream Alabama Power projects do not normally release as much water on weekends as weekdays, The Robert F. Henry pool can be expected to be at its lowest level on Monday and highest level on Friday during the period.

7-06. **Operation of Spillway Gates**. The spillway gates will be operated as directed by the Power Project Superintendent in order to maintain the pool between elevations 124.0 and 126.0 except during floods with inflows in excess of spillway capacity. When inflow and pool conditions require operation of the spillway, the gates will be operated in the order and increments of openings shown on Plates 7-3 through 7-10. The 11 spillway gates are numbered in sequence beginning at the right bank or west end of the spillway, adjacent to the powerhouse. Gate adjustments will be made as necessary and as specified by the above mentioned plates to maintain the pool between limiting elevations 124.0 and 126.0. For inflows in excess of spillway capacity the gates will be left in the fully open position until the pool has peaked and recedes to elevation 125.0. When this elevation is reached the operator will begin closing gates to pass the inflow, in excess of power plant and lock operation discharge, necessary to keep the pool within the established limits.

7-07. **Navigation**. During normal flow periods, no special water control procedures are required for navigation at the Robert F. Henry project other than maintaining the proper pool level. The normal maximum allowable drawdown at elevation 123.0 provides a clearance of 13.0 feet over the upper lock sill and should provide minimum depths for a 9-foot navigation channel at Montgomery and up to Bouldin Dam. Navigable depth is normally available downstream of the project if Millers Ferry is within its normal operating level. However, shoaling between Selma and Robert F. Henry may result in the need to make water releases to increase the depth over any shoals. This will be accomplished by regular or specially scheduled hydropower releases when possible.

a. **Flood Periods**. Navigation will be discontinued through the Robert F. Henry lock during flood periods when the headwater reaches elevation 131.0. At this elevation the discharge will be 156,000 cfs which is expected to occur on an average of once every 3 years and the freeboard will be 1.0 foot on the guide and lock walls.

b. **Low-Flow Periods**. The navigation channel below Claiborne Lock and Dam was designed for a 9-foot depth with a minimum flow of approximately 8,500 cfs and it may be necessary during periods of low flow and minimum pool level at that project to supplement the flows with releases from Robert F. Henry and Millers Ferry to the extent that water is available in the available pondage in each project.

7-08. **Flood Control**. There is no flood control storage in the Robert F. Henry project. Flood control at upstream projects has little effect on flows or levels at Robert F. Henry. Therefore, flowage easements have been obtained encompassing all lands subjected to an

increased frequency of flooding from the operation of the project. Paragraph 2-04 describes the real estate acquisition lines.

7-09. **Minimum Flow Agreement**. Flow in the Alabama River is largely controlled by Alabama Power Company impoundments on the Coosa and Tallapoosa Rivers above Robert F. Henry Lock and Dam. Pursuant to articles in the Federal Energy Regulatory Commission licenses for these impoundments, a minimum discharge must be released to support navigation on the Alabama River. Although this agreement is for the purpose of navigation, the flow has generally been insufficient for economic navigation. However, it is significant as an environmental or water quality minimum flow. Under the terms of the current negotiated agreement, APC projects will provide sufficient releases from the Coosa and Tallapoosa Rivers to meet a continuous minimum 7-day average flow of 4,640-cfs (32,480 dsf/7 days). However, additional intervening flow or drawdown discharge from Robert F. Henry and Millers Ferry reservoirs must be used to provide a usable depth for navigation or meet the 7Q10 flow of 6,600-cfs at Claiborne Lock and Dam.

7-10. **Drought Contingency Plan**. Engineering Regulation ER 1110-2-1941, dated 15 September 1981, called for the development of drought contingency plans for Corps of Engineers reservoirs. The following plan will be used during drought conditions.

a. **General.** The Robert F. Henry project is authorized for navigation and the production of hydroelectric energy with very limited storage within the reservoir. The project is almost totally dependent upon releases of water from upstream Alabama Power Company dams to meet the authorized functions. The runoff from the uncontrolled drainage area is not sufficient to meet environmental and/or navigational needs. Therefore, the District and Alabama Power Company have instituted a minimum flow agreement to provide environmental protection and assist navigation interest on the lower river as described above. However, the minimum flow agreement will not provide for either full-depth navigation or maintenance of 7Q10 flow. For short periods of time, it is possible for Corps reservoirs to utilize water from storage which, when combined with local inflows and the minimum agreed flow, can provide a discharge of approximately 6,600 cfs, the 7Q10 flow at Claiborne. However, the limited storage afforded in both Robert F. Henry and Millers Ferry reservoirs could only assist in meeting the 6,600-cfs for a short period. As local inflows diminish or the storage is exhausted, a lessor amount would be released depending on the amount of local inflows.

b. **Assessing the Situation.** There is no known method of predicting how severe or when a drought will occur. There are, however, several indicators that are useful in determining when conditions are favorable: below normal rainfall; lower than average inflows; and low reservoir levels, especially immediately after the spring season when rainfall and runoff conditions are normally the greatest. When conditions indicate that a drought is imminent, the Water Management Section evaluate the impacts on reservoir projects of Alabama Power Company, Corps projects, and navigational interests if drought conditions continue or become worse for 30-60-90 day periods, operating under existing low flow requirements, such as the minimum flow agreement and navigation

needs. Additionally, the WMS will determine if a change in operating criteria would aid in the total operation of the river system and if so, what changes would provide the maximum benefits from any available water.

c. **Coordinating.** When conditions determine that a change in the operating guidelines are necessary, it is important that various users of the system are notified so that any environmental or operational preparations can be completed prior to any impending reductions. Also, private industries, state agencies and federal agencies with interests in the river system will be notified. When drought conditions are deepening and a reduction in project discharge is mandated, the following will be notified as soon as practical:

STATE AGENCIES	FEDERAL AGENCIES	PRIVATE INDUSTRIES
Alabama Department of Environmental Management	U. S. Fish and Wildlife Service	Alabama Power Company
Alabama Department of Economic and Community Affairs	U. S. Geological Survey	Alabama River Pulp Mill
Alabama Geological Survey		MacMillian Bloedel, Inc.
Alabama Department of Conservation and Natural Resources		Union Camp Corporation
Alabama Department of Public Health		Hammermill Papers Group
		General Electric Corporation
		navigation companies

* This list will be updated as others locate on the river system or express an interest in the operation of the river system.

Normally the agencies will be advised of any impending reductions well in advance, and their comment will be requested regarding any adverse impacts on the respective agency or industry. All responses will be evaluated. If a flow reduction will result in a serious problem that can be rectified within a short time frame, consideration will be given to delaying any flow reduction. Further, if conditions indicate that a reduction in the minimum flow agreement is in the best interest of the users of the river system, the WMS will discuss with Alabama Power Company and state agencies to answer any operational and environmental questions prior to any modification to that agreement. However, there will be times when it will be impossible to notify all agencies prior to implementing discharge reductions. When this condition exists, the notification will be performed as soon as practical afterwards. During a severe drought this process may be repeated numerous times.

In addition, as conditions develop that indicate that a possibility of a drought is beginning, the Corps will provide routine press releases to the general public advising on operational and climatological conditions throughout the river basin. Also, public meetings will be conducted throughout the basin as necessary to keep major industries

and the general public informed on impending conditions and to solicit comments regarding potential changes in project operation.

7-11. **Recreation**. Although there are normally no water control actions for recreation, the project does enhance the opportunities for water-oriented recreation. Paragraph 2-05 describes the public facilities available at the project. Occasionally, releases may be scheduled for special recreational events such as river float trips.

7-12. **Water Quality**. Flows from Robert F. Henry are used downstream to provide the 7Q10 flow of 6,600 cfs below Claiborne. Several industries on the Alabama River have designed effluent discharges based on this dilution flow. Whenever flows recede to this level, conditions will be closely monitored so adequate warning can be given if it is necessary to reduce the flows even further. Paragraph 7-10 explains the procedures to be followed should the outflow drop to a level which is not sufficient enough to provide enough flow downstream.

7-13. **Fish and Wildlife**. The impoundment is favorable for the establishment of a sports fishery. The pool will be maintained at a fairly constant level except during floods when high inflows cause a rise in the reservoir level. This relatively stable pool during the spring spawning season is beneficial to the production of crappie, large mouth and small mouth bass, shellcracker, warmouth, and sunfishes. However, because of the regulation of the project for navigation and hydropower, it will generally not be possible to maintain the optimum conditions for fish spawn that may be accomplished at other projects.

7-14. **Emergency Operations During Communication Outages**. Normally the Water Management Section will arrange changes in generation schedules that are necessary to keep the pool level within the limiting elevations, 123.0 and 126.0. However, if there is an unexpected change in the inflow and a breakdown in communications makes it impossible for the powerhouse operating personnel to contact someone in the Water Management Section the following procedures will be followed until communications can be reestablished:

a. If there is an increase in the inflow which indicates that additional discharge is necessary to hold the pool at not higher than elevation 126.0 and the existing power schedule does not call for full plant capability, the operator should call SEPA and request agreement to such increased generation as necessary to prevent discharge through the spillway up to a maximum of full plant capability determined by safe operating limits for equipment. In case contact with SEPA is impossible, the pool will be maintained below 126.0 by opening spillway gates. If still greater discharge is required, it will be through the spillway to prevent the pool from rising above elevation 126.0.

b. If the inflow drops below the predicted amounts so that the existing generation schedule will cause the pool to drop below elevation 123.0, the power plant operators will contact SEPA if possible and try to arrange for a temporary reduction in the schedule. If SEPA cannot be contacted or if conditions on the system will not permit a reduction in the schedule, then the schedule will be followed until communications can be

reestablished with the district office. If this operation causes the pool to drop below elevation 123.0 the power plant operator will advise the lock operating personnel so that they can take steps to warn navigation interests on the river. In no case will releases be made when the pool is below elevation 122.0 unless specifically directed by the Water Management Section.

7-15. **Passing Drift**. In order to pass drift through the gated spillway, it may be necessary to occasionally raise the trash gate in Gate 1. The time to raise the trash gate to pass the drift should be as short a duration as practical to prevent unnecessary scouring of the channel below the spillway. The minimum tailwater elevation for passing drift is 123.0 feet. The lockmaster should write all drift passing procedures on the Washing Drift Log Sheet and send a copy to the Water Management Section. A discharge-rating curve for the trash gate is shown on Plate 7-11.

7-16. **Mosquito-Control**. Since the Robert F. Henry Reservoir is primarily for navigation, controlled fluctuation of the pool in excess of the power pondage is not desirable. Therefore water-level management is not considered as part of the mosquito-control program. Mosquito-control operations will consist primarily of clearing the reservoir of undesirable debris and vegetation, periodic inspections for adult mosquitoes and larva, the application of larvicides as necessary, aquatic plant control, and drift removal operations.

VIII - EFFECT OF WATER CONTROL PLAN

8-01. **General**. Robert F. Henry Lock and Dam is a peaking project with very little storage capacity between the maximum and minimum operating pool elevations of 126.0 and 123.0.

8.02. **Flood Regulation**. Robert F. Henry Lock and Dam has no flood control storage and, therefore, has no significant impact on floods. The maximum discharge frequency curve is shown on Plate 8-1, and the headwater and tailwater stage frequency curves are shown on Plate 8-2. The effect of reservoir regulation on the project flood of record, March 1990, and the flood of record at Selma, Alabama, February 1961, is shown on Plates 8-3 and 8-4. Regulation of the standard project flood series is shown on Plate 8-5 and the spillway design flood series on Plate 8-6.

8-03. **Droughts and Seasonal Low Flow Regulation**. During droughts or seasonal low flow periods the limited storage at the project is beneficial only as a means of reregulating releases from upstream storage reservoirs. The negative effects of low flow are also mitigated as described in paragraph 7-10, Drought Contingency Plan.

IX - WATER CONTROL MANAGEMENT

9-01. **Project Operator**. The Robert F. Henry project is a federal structure operated by the U. S. Army Corps of Engineers. It is part of the Alabama River navigation system.

9-02. **Operating and Regulating Offices**. Within the Mobile District, reservoir operations are under the supervision of Operations Division, and operating instructions are normally issued through the Division Chief. The Water Management Section in the Engineering Division monitors the project for compliance with the approved water control plan. When necessary, the Water Management Section instructs the Project Operator regarding normal procedures and most emergencies. The Robert F. Henry project is tended by operators under direct supervision of a lockmaster who in turn reports to the Project Manager at the BWT/Alabama-Coosa Project Management Office in Tuscaloosa, Alabama.

9-03. **Interagency Coordination**. The Corps' cooperative gaging programs with the National Weather Service and the U. S. Geological Survey are used within the basin to supplement the Corps' gaging activities. Coordination of river forecasts with the National Weather Service is explained in paragraphs 6-2 and 6-3. Coordination of power production with the Southeastern Power Administration is explained in paragraphs 7-05 and 7-05a. Coordinating water management activities with local interest groups such as water development associations, river navigation groups, recreation interests, state and federal agencies and others is accomplished as required on an ad-hoc basis. The BWT/Alabama-Coosa Project Management Office or the Technical Services Branch of Operations Division is often the contact point with the public and local agencies. The Water Management Section evaluates and explains the water management activities on the Alabama River.

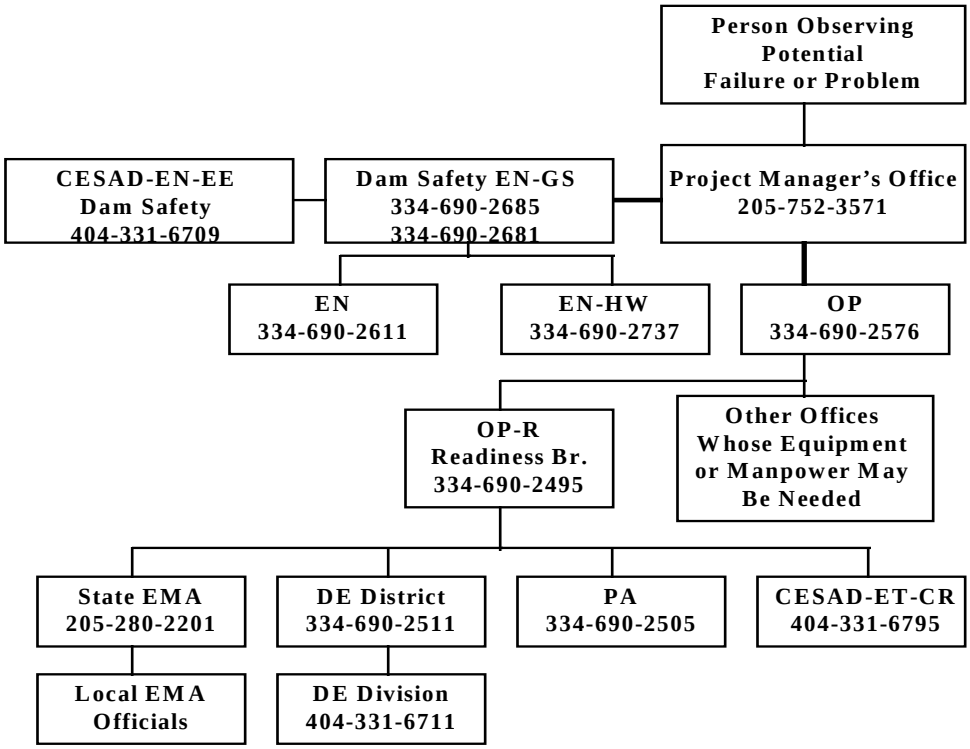
9-04. **Framework for Water Management Changes**. Special interest groups often request modifications of the water management plan. Robert F. Henry Lock and Dam was not built as a storage project and major changes in the regulation plan would require modifying, either the project itself or the purposes for which it was built. However, continued increases in the use of water resources demand constant monitoring and evaluating reservoir operations and reservoir systems to insure their most efficient use. The regulation plan and operating techniques are often reviewed to see if improvements are possible without violating authorized project functions.

9-05. **Information Bulletins**. The Water Management Section posts the daily River bulletin, weather forecasts, and river forecasts on the section's e-mail bulletin board. In addition to this data, historical project data, project maps, and other information can be found on the Mobile District-Water Management Section homepage on the internet at http://www.sam.usace.army.mil/sam/en/enhw/enhw.htm. When navigation is restricted due to high water, insufficient depth, or lock closures the Water Management Section and Operations Division coordinate closely in preparing navigation bulletins for these periods. The Corps tries to give users a 4 to 7 day notice of the river conditions; however, with limited project storage and unexpected circumstances on the Alabama River projects it is

not always possible. During floods the Water Management Section prepares daily flood bulletins in cooperation with the Readiness Branch of Operations Division of the Mobile District Office. The Water Management Section also works with the Public Affairs Office to prepare news releases. During the hurricane season, the Water Management Section posts tropical updates.

9-06. **Dam Safety**. The Robert F. Henry Dam is a low head project with a 47-foot maximum differential between headwater and tailwater. With the existing pool limitations plus the minimum flow requirements, a head of 47 feet is highly unlikely except during an extreme drought. The reservoir is contained mostly within its natural river banks, and a dam failure would tend to fill the stream channel at most. A dam failure during a major flood would have practically no effect on downstream flooding and possibly could go undetected until the floodwaters recede.

a. **Notification**. If a dam failure is suspected then the observer will contact the Project Manager's Office. The following flow sheet depicts the notification procedure:



b. **Coordination**. The Area Engineer for Operations Division and Water Management Section personnel will notify constituents of the Mobile District Office and local Civil Defense Agencies. This should help prevent delays in communications. The emergency notification procedures document, CESAM Plan 500-1-4, is kept in the Water Management Section office and explains the notification and coordination procedures.

EXHIBIT A

SUPPLEMENTARY PERTINENT DATA

GENERAL

Other names of project	Jones Bluff
Dam site location	
State	Alabama
Basin	Alabama-Coosa
River	Alabama
Miles above mouth of Alabama River	245.40
Type of project	Dam, Reservoir and Power plant
Objectives of regulation	Navigation, Power
Project Owner	United States of America
Operating Agency/ Regulating Agency	U. S. Army Corps of Engineers

STREAM FLOW AT DAM SITE (Dam in place)

Period of Record	1975-1996
Maximum discharge	
Daily (3/20/90)	218,355
Minimum discharge	
Daily (5/29/78)	138

REGULATED FLOODS

Maximum flood of project record (Mar. 1990)	
Peak inflow, cfs	279,044
Peak outflow, cfs	220,000
Peak pool elevation, feet above NGVD	136.8
Maximum flood of continuous record (Feb. - Mar. 1961)	
Peak inflow, cfs	291,700
Regulated peak outflow, cfs	278,500
Regulated peak pool elevation, feet above NGVD	138.6
Standard project flood series	
Peak inflow, cfs	421,000
Regulated peak outflow, cfs	410,500
Regulated peak pool elevation, feet above NGVD	142.3
Spillway design flood series	
Peak inflow, cfs	738,000
Regulated peak outflow, cfs	725,500
Regulated peak pool elevation, feet above NGVD	148.0

RESERVOIR

Normal pool elevation, feet above msl	125.0
Maximum operating pool elevation, feet above msl	126.0

Minimum operating pool elevation, feet above msl	123.0
Total drainage area above Robert F. Henry dam site	
Square miles	16,300
1 inch of runoff equals, acre-ft	869,333
Area at pool elevation 125.0, acres	12,510
Area acquired in fee simple, acres	4,469
Area acquired by easement, acres	20,000
Area cleared, acres	6,050
Maximum elevation of clearing, feet above msl	130.0
Total volume to elevation 125.0, acre-feet	234,200
Length at elevation 125.0, miles	80.5
Shoreline distance at elevation 125.0, miles	368

LOCK

Nominal size of chamber, feet	84 x 600
Distance center to center of gate pintles, feet	655
Maximum lift, feet	47.0
Elevation of upper stop-log sill, feet above msl	109.0
Elevation of upper miter sill, feet above msl	109.0
Elevation of lower stop-log sill, feet above msl	67.0
Elevation of lower miter sill, feet above msl	67.0
Elevation of chamber floor, feet above msl	66.0
Elevation of top of floor culverts, feet above msl	66.0
Elevation of top of upper approach walls, feet above msl	132.0
Elevation of top of upper gate blocks, feet above msl	143.0
Elevation of top of chamber walls, feet above msl	132.0
Elevation of top of lower guide walls, feet above msl	132.0
Freeboard on guide walls when lock becomes inoperative, feet	1.0
Percent of time inoperative	0.4
Type of upper gate	horizontally framed miter
Height of upper gate, feet	34
Type of lower gate	horizontally framed miter
Height of lower gate, feet	65
Type of culvert valves	reverse tainter
Dimensions of culverts at valves, feet	10 x 10
Dimensions of culverts at laterals, feet	10 x 15.50
Elevation of culvert ceilings between valves, feet above msl	74.0
Minimum submergence of culvert valves, feet	5.0
Type of filling and emptying system	floor culverts
Type of emergency dams	stop logs
Elevation of top of upstream emergency dam, feet above msl	126.7
Elevation of top of downstream emergency dam, feet above msl	97.9
Type of operating machinery	hydraulic oil pressure

SPILLWAY

Total length, including end piers, feet	646
Net length, feet	550
Elevation of crest, feet above msl	91.0
Number of piers, including end piers	12
Width of piers, feet	8
Type of gates	tainter
Number of gates	11
Length of gates, feet	50
Height of gates, feet	35
Maximum discharge capacity (pool elev. 125.0), cfs	124,500
Elevation of top of gates in closed position, feet above msl	126.0
Elevation of low steel of gates in fully open position, feet above msl	143.6
Elevation of trunnion, feet above msl	124.0
Elevation of access bridge, feet above msl	158.5
Elevation of stilling basin apron, feet above msl	66.0 to 81.0
Length of stilling basin, feet	62 to 72
Height of end sill, feet	5.0

EARTH OVERFLOW DIKES

Right Bank Dike	
Total length, feet	2,661
Top elevation, feet above msl	135.0
Top width, feet	32
Side slopes	1 on 8
Thickness of riprap on slopes, inches	24
Thickness of filter blanket, inches	9
Maximum swellhead when dike is overtopped, feet	1.4
Recurrence interval of flood which will overtop dike, years	9
Freeboard, top of dike above normal upper pool, feet	10
Left Bank Dike	
Total length including lock mound, feet	12,639
Top elevation, feet above msl	143.0
Top width, feet	32
Side slopes	1 on 2.5
Recurrence interval of flood which will overtop dike, years	9.0
Freeboard, top of dike above normal upper pool, feet	10
Freeboard, top of dike above headwater for Standard Project Flood series, feet	0.7

POWER PLANT

Maximum power pool elevation, feet above msl	126.0
Maximum normal drawdown elevation, feet	123.0
Temporary/Emergency drawdown elevation, feet	122.0
Maximum static head, feet	47
Average operating head without spillway discharge, feet	29

Rated net head,-feet	28.2
Operating head with one unit at full gate and pool elevation 125.0, feet	41.5
Minimum head for generation, feet	15.3
Length of powerhouse, feet	375
Width of powerhouse including intake structure, feet	160
Type of powerhouse construction	reinforced concrete
Type of intake gates	tractor
Number of intake gates	3/unit
Height of intake gates, feet	30
Width of intake gates, feet	17
Length of unit bay, feet	73
Number of units	4
Type of turbine	fixed blade
Maximum discharge per unit, cfs	8,800
Capacity of each turbine, hp	23,480
Elevation of centerline of distributor, feet above msl	96.0
Generator rating, kW	17,000
Total installation, kW	68,000
Dependable plant output during critical period, kW	68,000
Generator rating, kva	21,500
Generator speed, rpm	73.5
Generator, electrical characteristics	3 phase, 60 Hertz,.95 p.f.
Elevation of bottom of draft tube, feet above msl	39.0
Length of draft tube, feet	87
Type of draft tube gates	vertical slide
Number of draft tube gates	3/unit
Type of draft tube gate operation	positioned by gantry
Elevation of operating deck, feet above msl	143.0
Location of switchyard	right bank downstream
Elevation of switchyard and parking area, feet above msl	143.0
Transmission voltage, kv	115.0
Number of transformer bays	2
Number of 3-phase type transformers	2
Capacity of each transformer, kva	44,440
Average annual energy from plant, million kW-hr.	329.6

EXHIBIT B

UNIT CONVERSION TABLE

AREA CONVERSION

UNIT	m^2	km^2	ha	in^2	ft^2	yd^2	mi^2	ac
1 m^2	1	10^{-6}	10^{-4}	1550	10.76	1.196	3.86×10^{-7}	2.47×10^{-4}
1 km^2	10^6	1	100	1.55×10^9	1.076×10^7	1.196×10^6	0.3861	247.1
1 ha	10^4	0.01	1	1.55×10^7	1.076×10^7	1.196×10^4	3.86×10^{-3}	2,471
1 in^2	6.45×10^{-4}	6.45×10^{10}	6.45×10^{-8}	1	6.94×10^{-3}	7.7×10^{-4}	2.49×10^{-10}	1.57×10^7
1 ft^2	.0929	9.29×10^{-8}	9.29×10^{-6}	144	1	0.111	3.59×10^{-8}	2.3×10^{-5}
1 yd^2	0.8361	8.36×10^{-7}	8.36×10^{-5}	1296	9	1	3.23×10^{-7}	2.07×10^{-4}
1 mi^2	2.59×10^6	2.59	259	4.01×10^9	2.79×10^7	3.098×10^6	1	640
1 ac	4047	0.004047	0.4047	6.27×10^6	43560	4840	1.56×10^{-3}	1

LENGTH CONVERSION

UNIT	cm	m	km	in.	ft	yd	mi
cm	1	0.01	0.0001	0.3937	0.0328	0.0109	6.21×10^{-6}
m	100	1	0.001	39.37	3.281	1.094	6.21×10^{-4}
km	10^5	1000	1	39,370	3281	1093.6	0.621
in.	2.54	0.0254	2.54×10^{-5}	1	0.0833	0.0278	1.58×10^{-5}
ft	30.48	0.3048	3.05×10^{-4}	12	1	0.33	1.89×10^{-4}
yd	91.44	0.9144	9.14×10^{-4}	36	3	1	5.68×10^{-4}
mi	1.01×10^5	1.61×10^3	1.6093	63,360	5280	1760	1

FLOW CONVERSION

UNIT	m^3/s	m^3/day	l/s	ft^3/s	ft^3/day	ac-ft/day	gal/min	gal/day	mgd
m^3/s	1	86,400	1000	35.31	3.05×10^6	70.05	1.58×10^4	2.28×10^7	22.824
m^3/day	1.16×10^{-5}	1	0.0116	4.09×10^{-4}	35.31	8.1×10^{-4}	0.1835	264.17	2.64×10^{-4}
l/s	0.001	86.4	1	0.0353	3051.2	0.070	15.85	2.28×10^4	2.28×10^{-2}
ft^3/s	0.0283	2446.6	28.32	1	8.64×10^4	1.984	448.8	6.46×10^5	0.646
ft^3/day	3.28×10^{-7}	1233.5	3.28×10^{-4}	1.16×10^{-5}	1	2.3×10^{-5}	5.19×10^{-3}	7.48	7.48×10^{-6}
ac-ft/day	0.0143	5.451	14.276	0.5042	43,560	1	226.28	3.26×10^5	0.3258
gal/min	6.3×10^{-5}	0.00379	0.0631	2.23×10^{-3}	192.5	4.42×10^{-3}	1	1440	1.44×10^{-3}
gal/day	4.3×10^{-8}	3785	4.38×10^{-4}	1.55×10^{-6}	11,337	3.07×10^{-6}	6.94×10^{-4}	1	10^{-6}
mgd	0.0438		43.82	1.55	1.34×10^5	3.07	694	10^6	1

VOLUME CONVERSION

UNIT	liters	m^3	in^3	ft^3	gal	ac-ft	million gal
liters	1	0.001	61.02	0.0353	0.264	8.1×10^{-7}	2.64×10^{-7}
m^3	1000	1	61,023	35.31	264.17	8.1×10^{-4}	2.64×10^{-4}
in^3	1.64×10^{-2}	1.64×10^{-5}	1	5.79×10^{-4}	4.33×10^{-3}	1.218×10^{-8}	4.33×10^{-9}
ft^3	28.317	0.02832	1728	1	7.48	2.296×10^{-5}	7.48×10^{6}
gal	3.785	3.78×10^{-3}	231	0.134	1	3.07×10^{-6}	10^{6}
ac-ft	1.23×10^{6}	1233.5	75.3×10^{6}	43,560	3.26×10^{5}	1	0.3260
million gallon	3.785×10^{6}	3785	2.31×10^{8}	1.34×10^{5}	10^{6}	3.0684	1

EXHIBIT C

STANDING INSTRUCTIONS TO THE PROJECT OPERATOR FOR WATER CONTROL

ROBERT F. HENRY LOCK AND DAM PROJECT

1. BACKGROUND AND RESPONSIBILITIES

a. **General Information**. These "Standing Instructions to the Project Operator for Water Control" are written in compliance with Paragraph 9-2 of EM-1110-2-3600 (Engineering and Design, *Management of Water Control Systems*, 30 November 1987) and with ER-1110-2-240 (Engineering and Design, *Water Control Management*, 8 October 1982). A copy of these Standing Instructions must be kept on hand at the project site at all times. Any deviation from the Standing Instructions will require approval of the District Commander.

(1) **Project Purposes**. The Robert F. Henry Lock and Dam project is operated for Hydropower and Navigation.

(2) **Chain of Command**. The Project Operator is responsible to the Water Control Manager for all water control actions.

(3) **Structure**. The Robert F. Henry Dam is located at Alabama River mile 245.4, Autauga County, Alabama. The dam is a concrete-gravity structure with a concrete-gravity gated spillway. The Powerhouse is located on the right bank, joined to the spillway on the east or river side. The Lock is located in the left bank between the spillway and the left overbank earth dike.

(4) **Operation and Maintenance (O&M)**. All O&M activities are the responsibility of the U. S. Army Corps of Engineers.

b. **Role of the Project Operator**.

(1) **Normal Conditions (dependent on day-to-day instruction)**. The Water Control Manager will coordinate the daily water control actions with SEPA. The Project Operator will then receive instructions from SEPA. This communication will be increased to an hourly basis if the need develops.

(2) **Emergency Conditions (flood, drought, or special operations)**. During emergency conditions, the Project Operator will be instructed by the Water Control Manager on a daily or hourly basis for all water control actions. In the event that communications with Water Management Section are cut off, the Project Operator will continue to follow the Water Control Plan and contact the Water Management Section as soon as communication is reestablished.

2. DATA COLLECTION AND REPORTING.

a. **General**. Report hourly the pool elevation, tailwater elevation, turbine discharge, spillway discharge, capacity, and general project status on the computer and have it accessible to the Water Control Manager by computer network.

b. **Normal Conditions**. The Project operator will record the following items daily, and will report them by 6:30 AM (0630) to the Water Management Section either by computer network, by fax machine (334-694-4058), or by telephone conversation (334-690-2737):

(1) Pool elevation in feet above mean sea level at 6 am and 12 midnight (0600 and 2400) for the period since the last report.

(2) Precipitation in hundredths of an inch.

(3) Average plant discharge in cubic feet per second for the first 4 hours of each day and for the 24 hours of the previous day.

(4) Average turbine discharge for the 24 hours of the previous day.

(5) Inflow to the lake in cubic feet per second for the first 4 hours of each day and for the 24 hours of the previous day.

(6) Current day's scheduled and previous day's actual generation in megawatt-hours. Include the schedule for the current day's generation.

(7) Total generating capacity of the plant in megawatts.

(8) Rainfall at 6 AM of the current day for the gages at Damascus, Shucktown, and Arundel. Stage and rainfall at 4 PM of the previous day and 6 AM of the current day for the gages at Marion Junction and Centreville. Gages may be added or deleted as requested by the Water Management Section.

c. **Regional Hydro-meteorological Conditions**. The project operator will be informed by the Water Control Manager of any regional hydro-meteorological conditions that may impact water control actions.

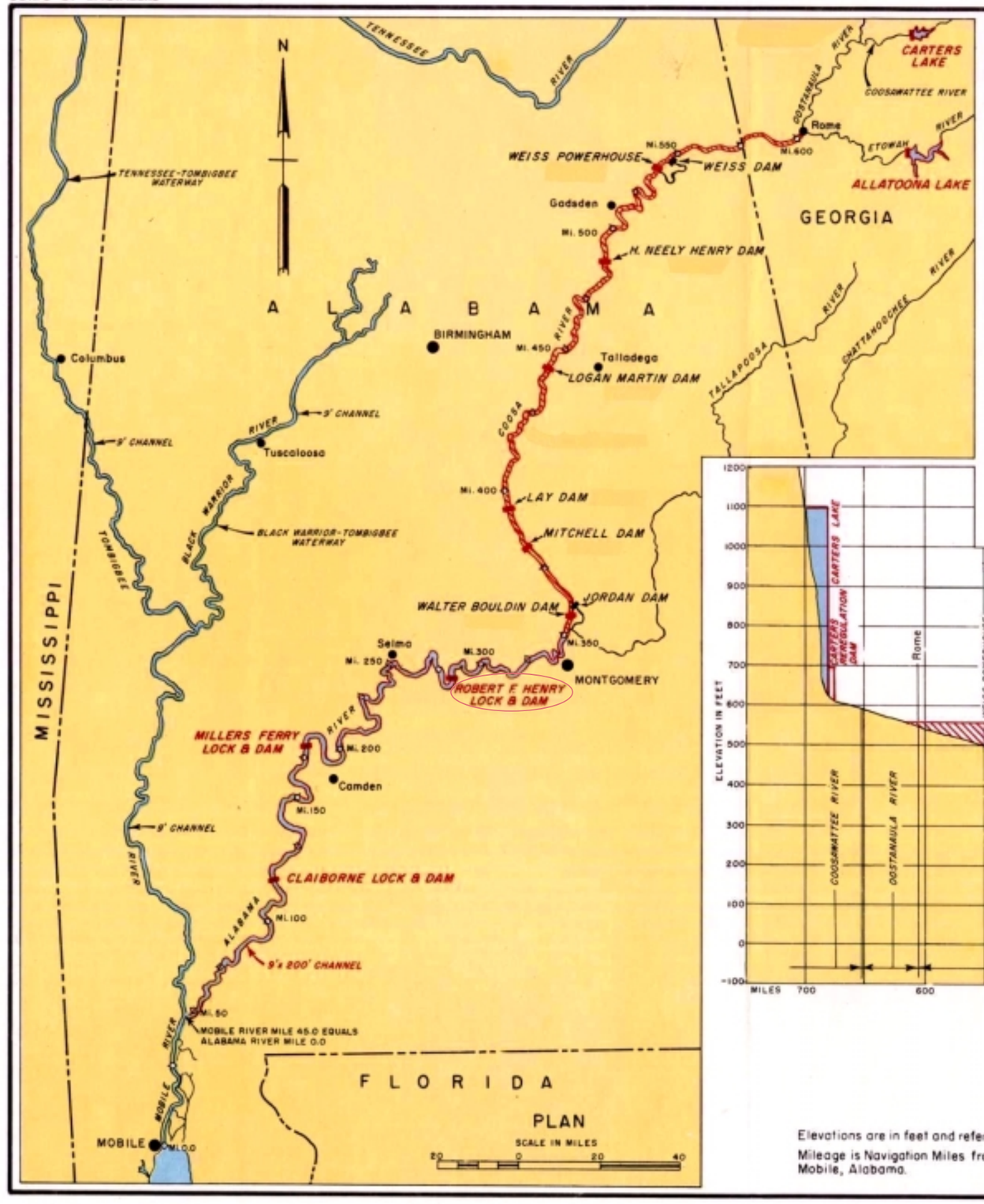
3. WATER CONTROL ACTION AND REPORTING

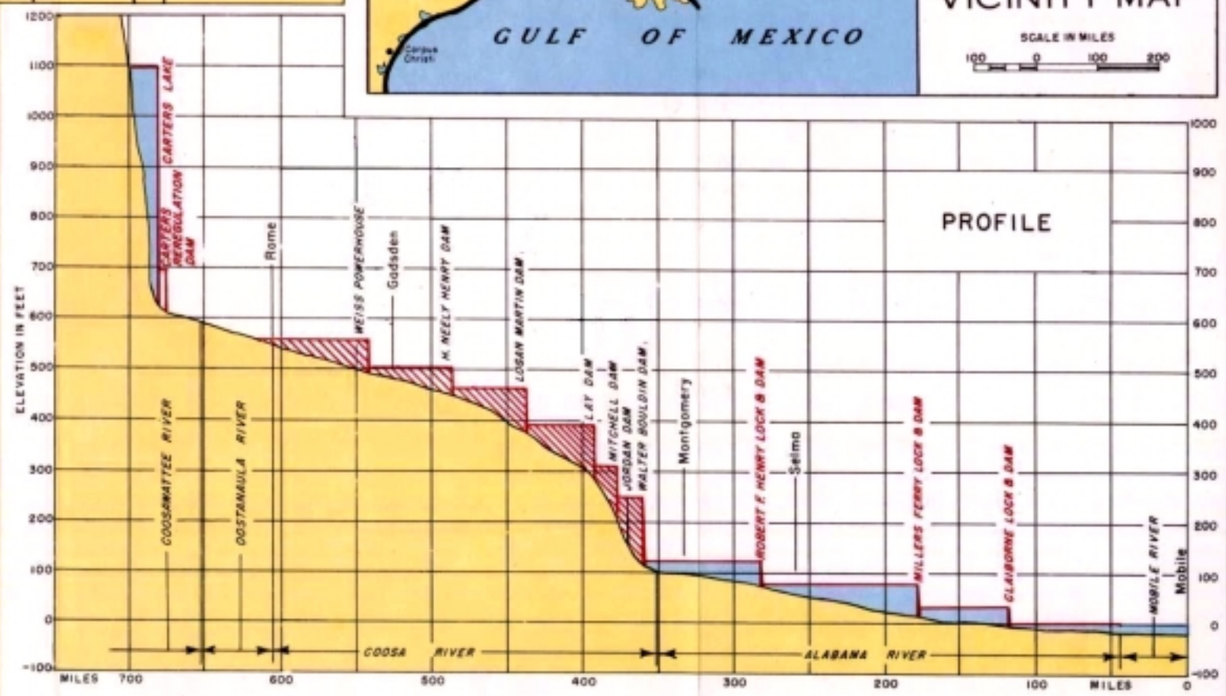
a. **Normal Conditions**. During normal conditions, all releases will be made through the turbine units. The Project Operator will follow the Robert F. Henry Water Control Manual for normal water control actions and will report directly to the Water Control Manager.

b. **Emergency Conditions**. During high flows, the operator at Robert F. Henry will follow the instructions for spillway gate settings given by the Project Operator at Millers Ferry and according to the Gate Operating Schedule. The generating units will be shut down when the operating head decreases to approximately 15.3 feet. During low flow conditions, the Project Operator will contact the Water Control Manager if the pool elevation reaches 122.5. If unable to reach Water Management Section, generating units will be shut down at elevation 122.0, and the Project Operator will notify Water Management and SEPA as soon as possible. In no case will releases be made when the pool is below elevation 122.0 unless specifically directed by the Water Management Section. The Project Operator will follow the Robert F. Henry Water Control Manual for emergency water control actions and will follow the Emergency Action Plan for emergency notification procedures.

c. **Inquiries**. All significant inquiries received by the Project Operator from citizens, constituents, or interest groups regarding water control procedures or actions must be referred directly to the Water Control Manager.

d. **Water Control Problems**. The Project Operator must immediately notify the Water Control Manager, by the most rapid means available, in the event that an operational malfunction, erosion, or other incident occurs that could impact project integrity in general or water control capability in particular.





Elevations are in feet and refer to National Geodetic Vertical Datum.

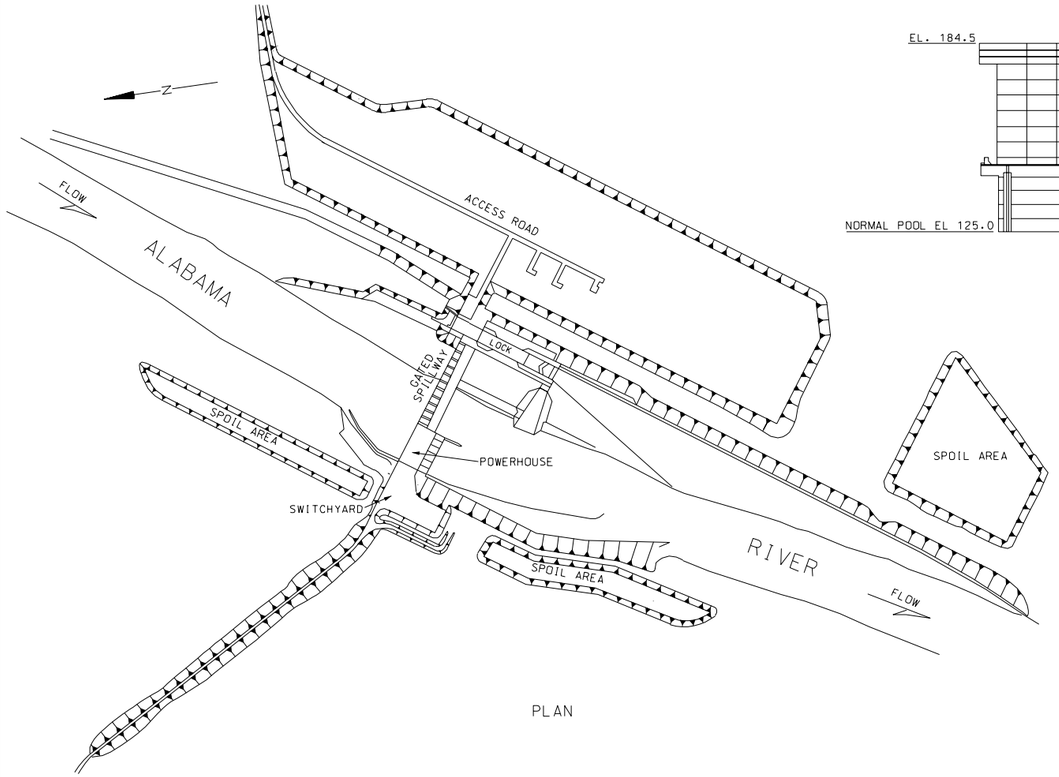
Mileage is Navigation Miles from the Bankhead Tunnel (U. S. Hwy. 90), Mobile, Alabama.

ALABAMA-COOSA BASIN
WATER CONTROL MANUAL

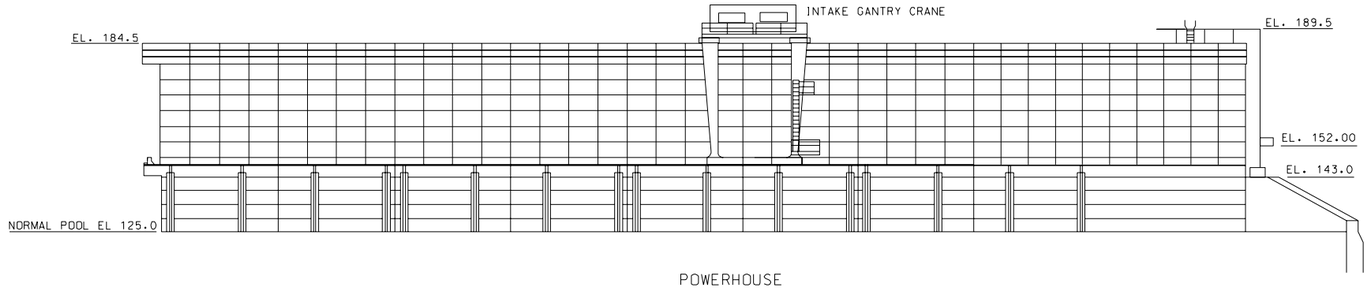
ROBERT F. HENRY LOCK AND DAM

ALABAMA RIVER, ALABAMA

LOCATION MAP

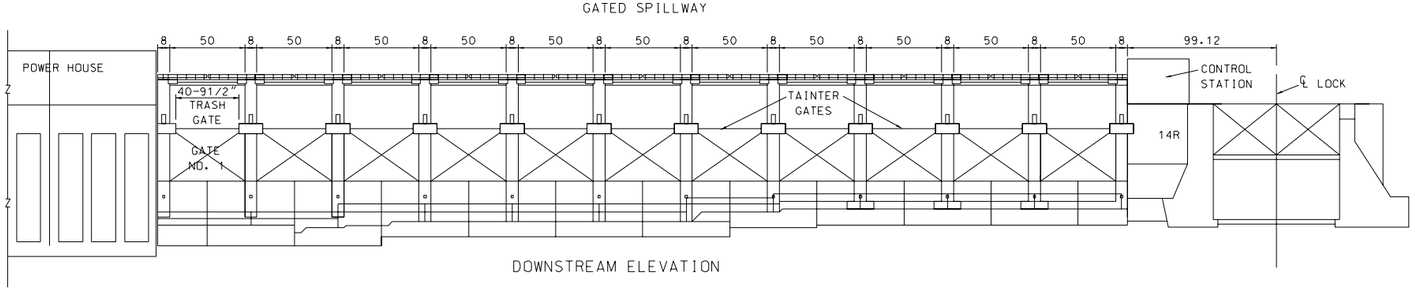


PLAN

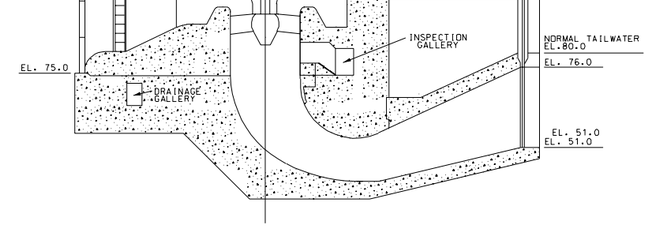


POWERHOUSE

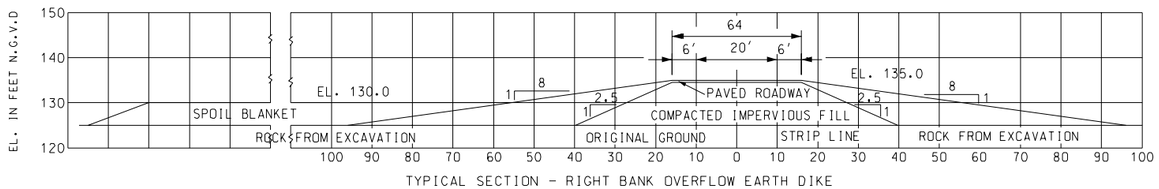
GATED SPILLWAY



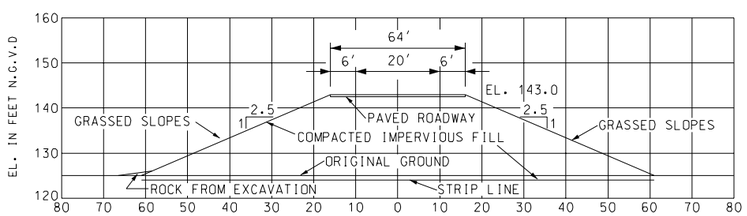
DOWNSTREAM ELEVATION



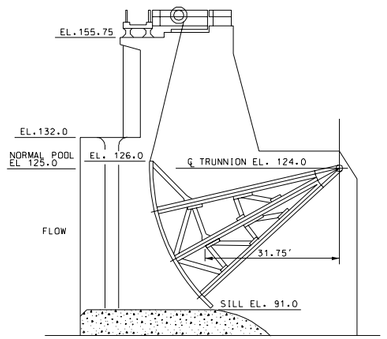
POWERHOUSE



TYPICAL SECTION - RIGHT BANK OVERFLOW EARTH DIKE



TYPICAL SECTION - LEFT BANK OVERFLOW EARTH DIKE

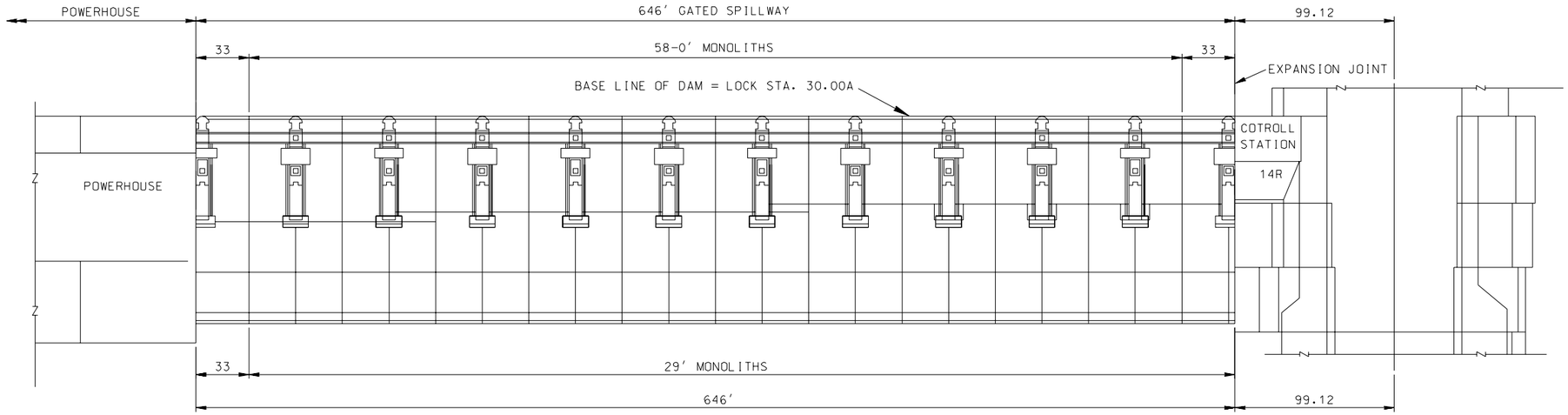


GATED SPILLWAY

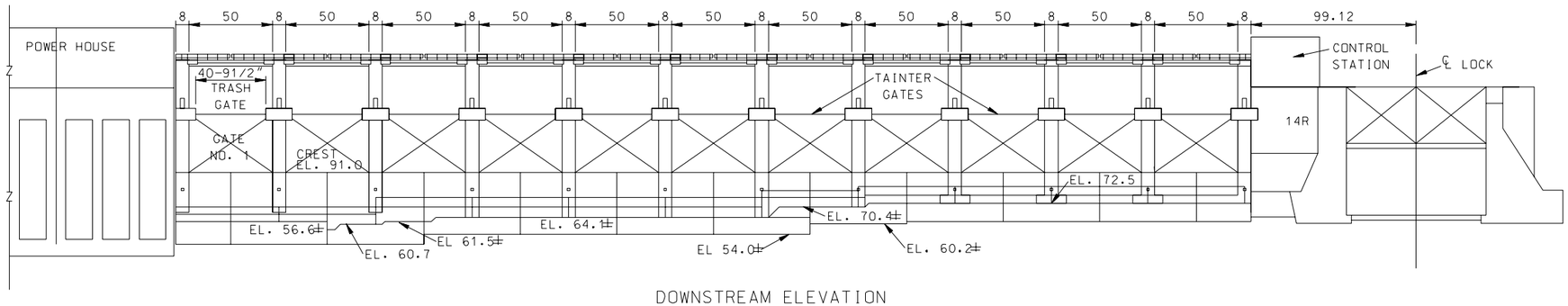
ALABAMA - COOSA BASIN
WATER CONTROL MANUAL

ROBERT F. HENRY L & D
ALABAMA RIVER, ALABAMA

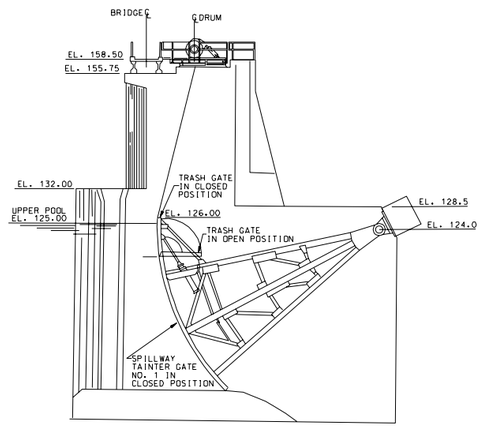
PLAN AND SECTION OF DAM, POWERHOUSE AND LOCK



PLAN



DOWNSTREAM ELEVATION

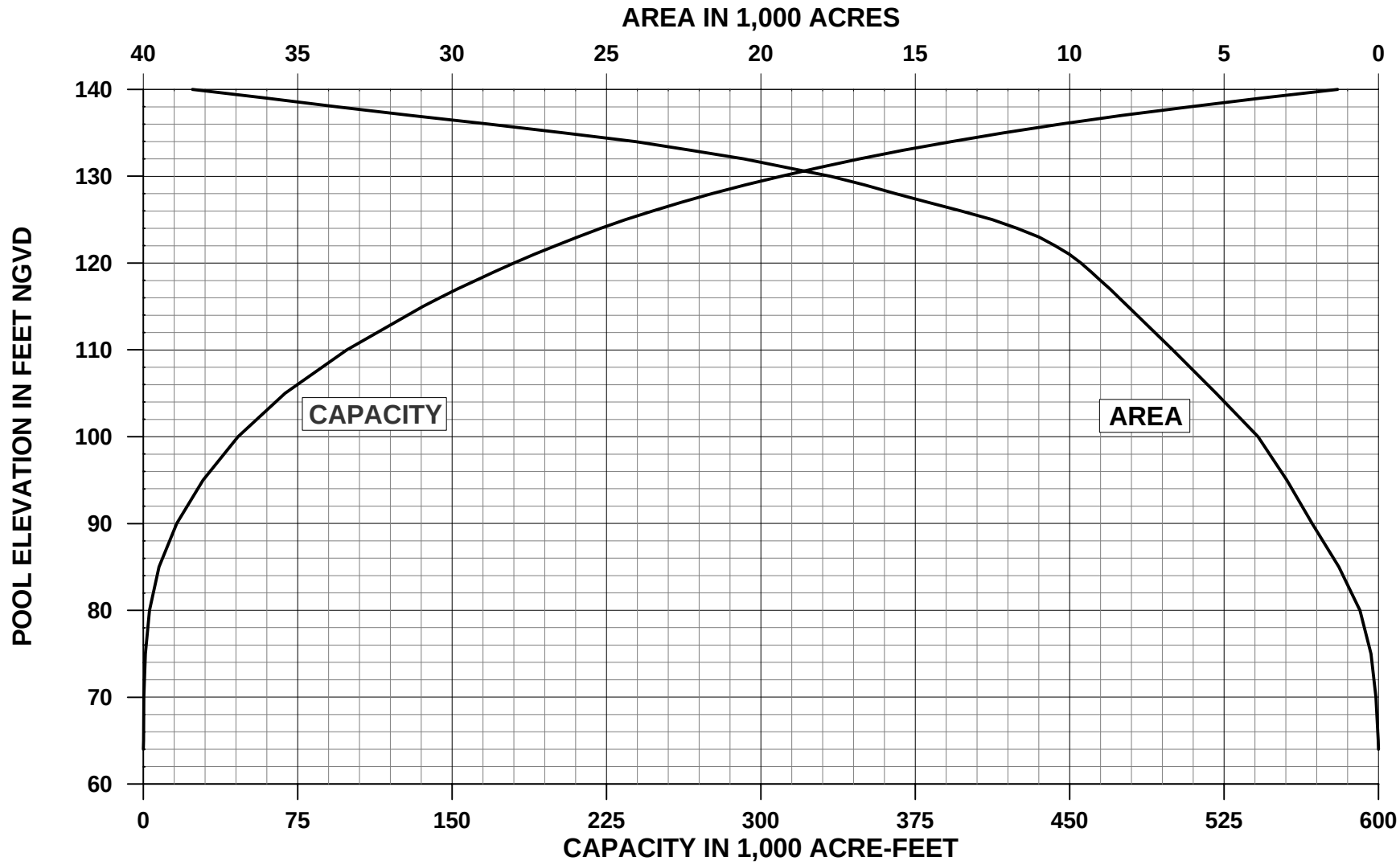


SPILLWAY GATE NO. 1 W/TRASHGATE

ALABAMA - COOSA BASIN
WATER CONTROL MANUAL

ROBERT F. HENRY L & D
ALABAMA RIVER, ALABAMA

GATE MODIFICATION
PLAN AND ELEVATION



ALABAMA-COOSA BASIN
WATER CONTROL MANUAL

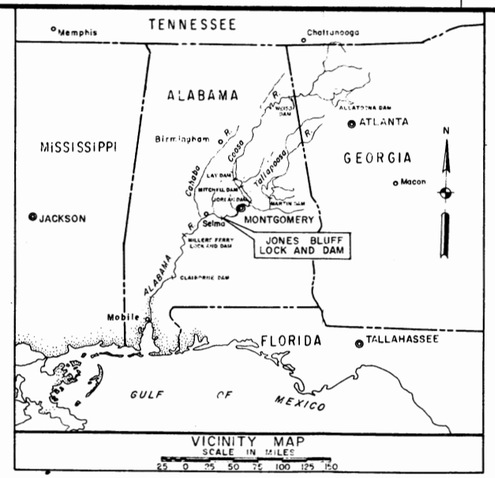
ROBERT F. HENRY LOCK AND DAM
ALABAMA RIVER, ALABAMA

AREA-CAPACITY CURVES

CORPS OF ENGINEERS

U.S. ARMY

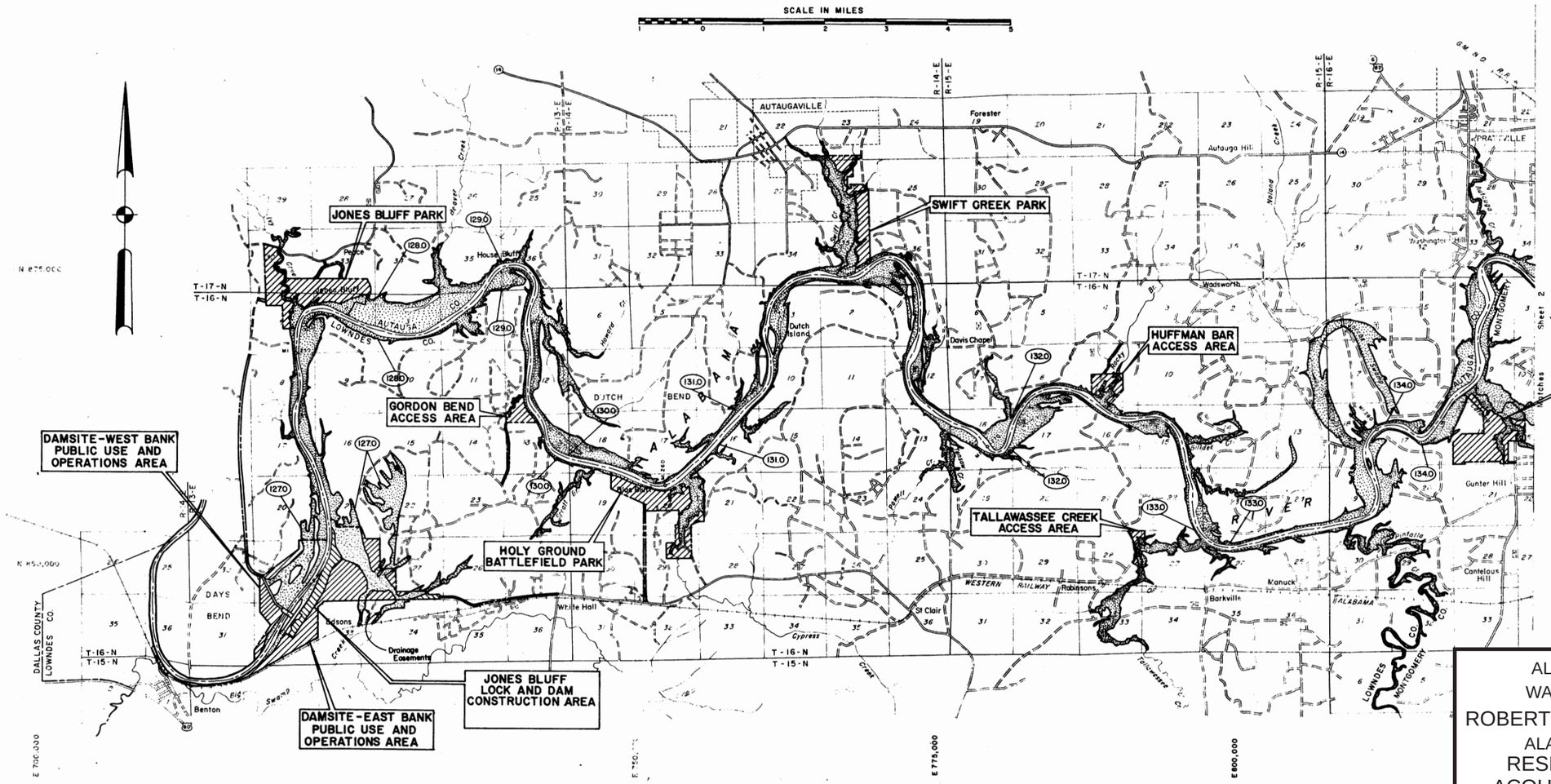
APPENDIX G PLATE NO. 2-4



E 700,000 E 725,000 E 750,000 E 775,000 E 800,000 E 825,000

N 900,000

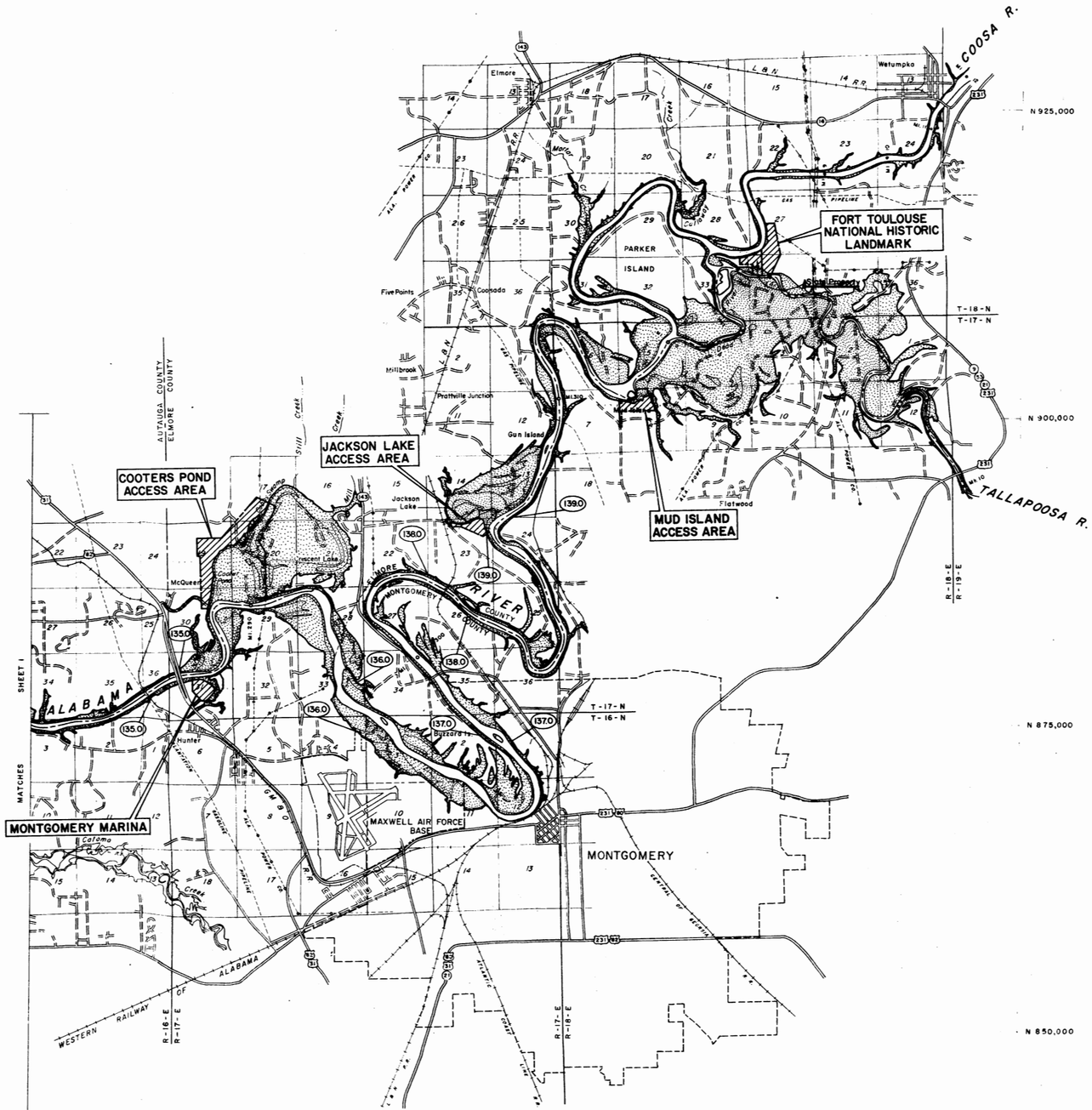
SCALE IN MILES



LEGEND

- Boundary of Fee Area
- Limit of Easement Area *(Elevations noted)* (100.0)
- Operations and Public Use Area Acquired in Fee
- Fee, Construction Area

ALABAMA - COOSA BASIN
WATER CONTROL MANUAL
ROBERT F. HENRY LOCK AND DAM
ALABAMA RIVER, ALABAMA
RESERVOIR REAL ESTATE
ACQUSITION AREA SHEET 1 OF 2

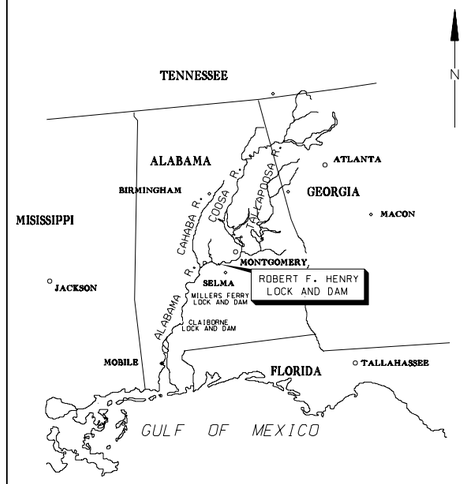


LEGEND

- Boundary of Fee Area
- Limit of Easement Area *(Elevations noted)*
- (100.0)
- Operations and Public Use Area Acquired in Fee
- Fee, Construction Area

ALABAMA - COOSA BASIN
WATER CONTROL MANUAL
ROBERT F. HENRY LOCK AND DAM
ALABAMA RIVER, ALABAMA
RESERVOIR REAL ESTATE
ACQUSITION AREA SHEET 2 OF 2

CORPS OF ENGINEERS U.S. ARMY



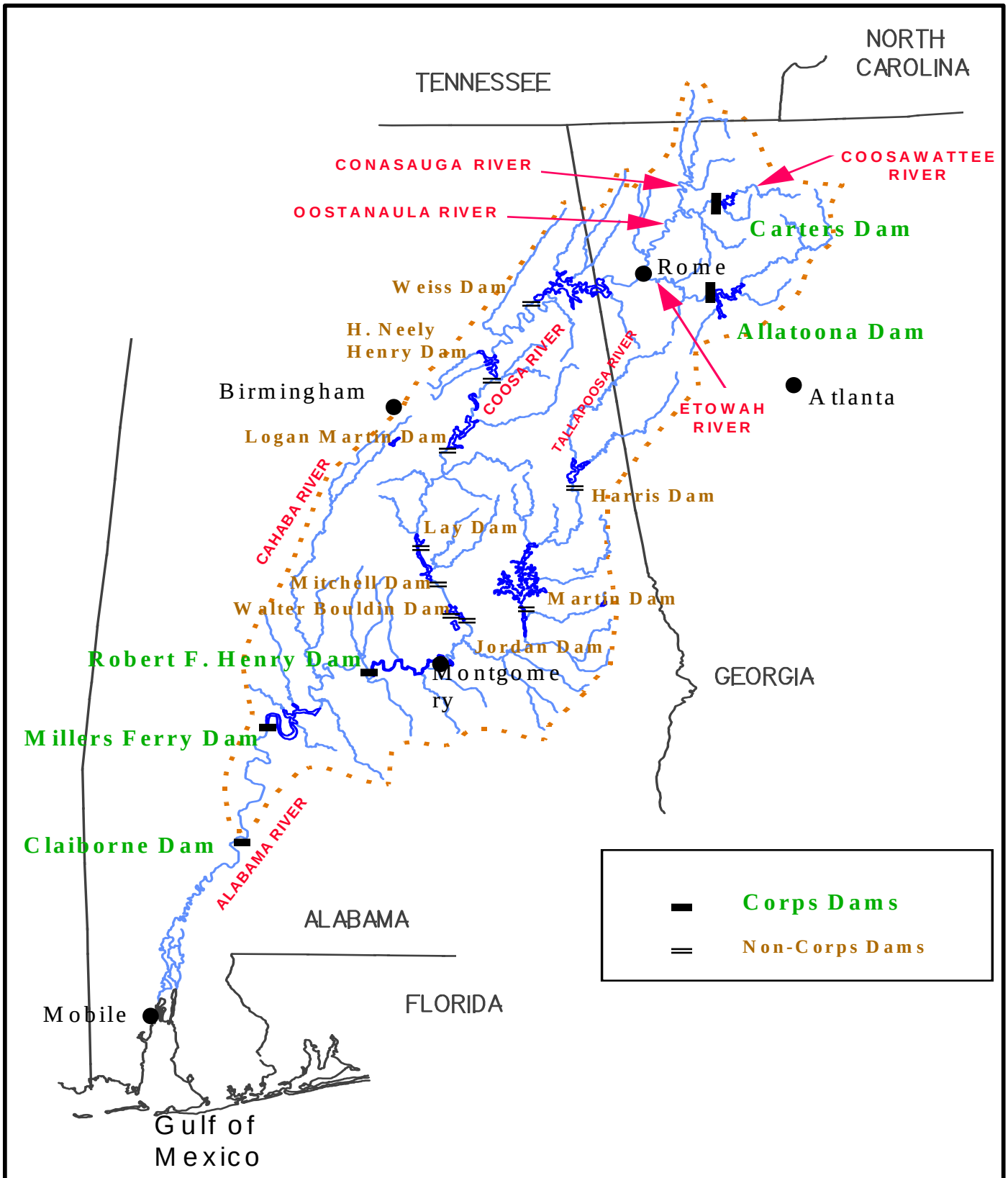
VICINITY MAP

ALABAMA - COOSA BASIN
WATER CONTROL MANUAL

ROBERT F. HENRY L & D
ALABAMA RIVER, ALABAMA

RECREATIONAL FACILITIES

APPENDIX G PLATE NO. 2-7

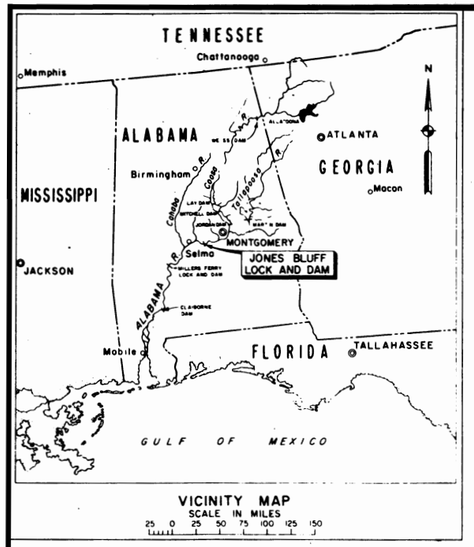


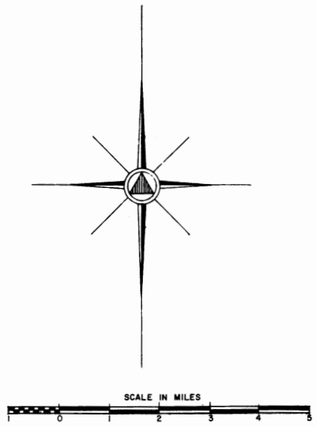
ALABAMA-COOSA BASIN
WATER CONTROL MANUAL

ROBERT F. HENRY LOCK AND DAM

ALABAMA RIVER, ALABAMA

ALABAMA-COOSA-TALLAPOOSA RIVER BASIN



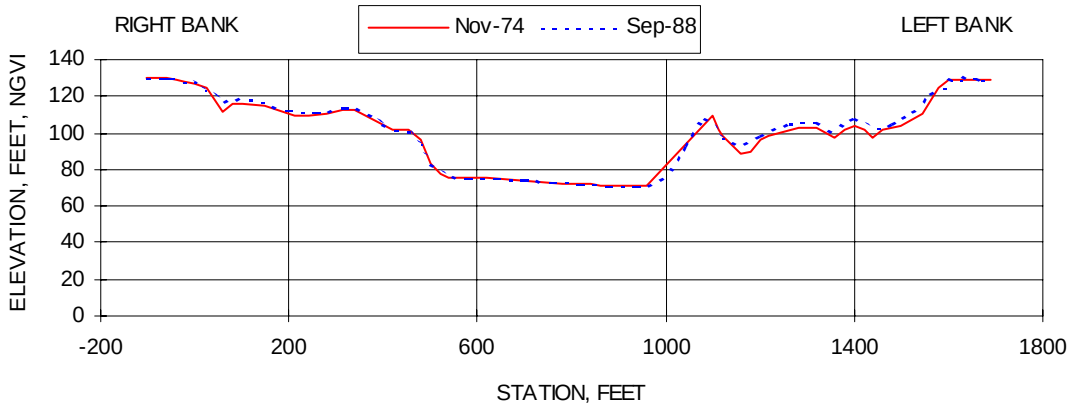


LEGEND

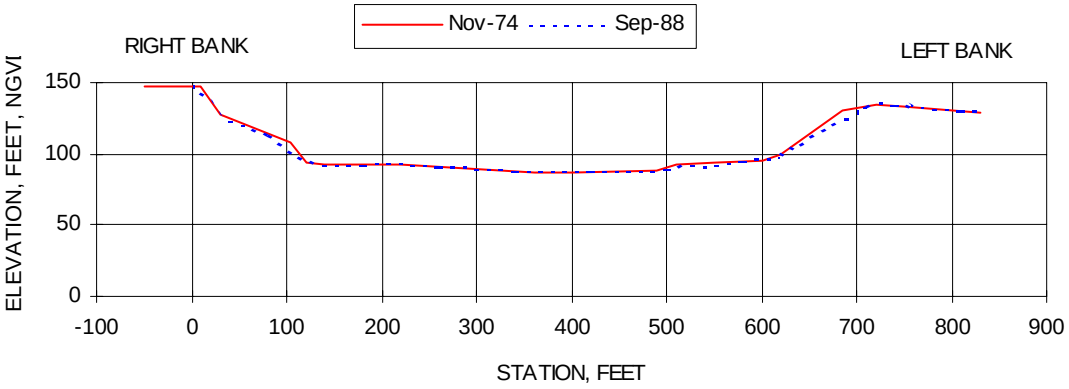
- Reservoir Ranges
- Paved Roads, U.S. & State Highways, County Roads
- Earth Roads
- R.O.W. Indicates Road Right-of-way Required
- Railroads
- Transmission Lines
- Telephone Lines
- County Line
- *Normal Pool Elevation 125.0*
- Proposed Public Use Area
- Operations Area, & Construction Site

ALABAMA - COOSA BASIN
WATER CONTROL MANUAL
ROBERT F. HENRY LOCK AND DAM
ALABAMA RIVER, ALABAMA
RESERVOIR MAP
SEDIMENTATION RANGES

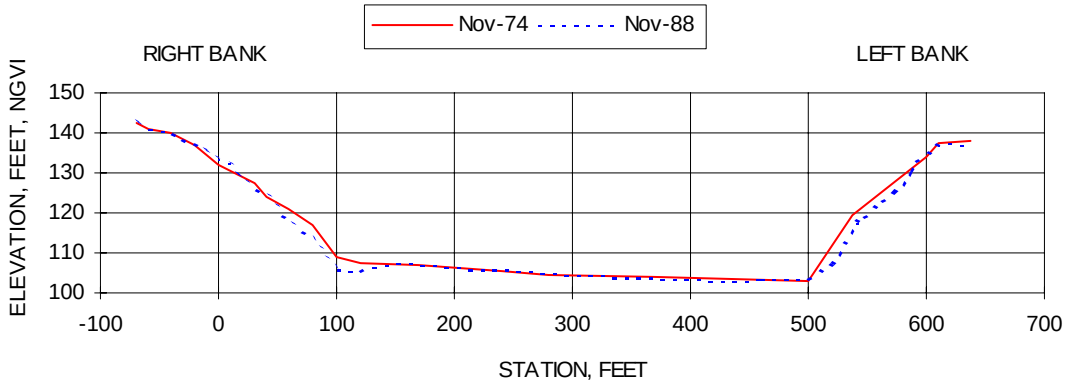
ROBERT F. HENRY POOL
SEDIMENTATION RANGE 01A



ROBERT F. HENRY POOL
SEDIMENTATION RANGE 08A



ROBERT F. HENRY POOL
SEDIMENTATION RANGE 17A



ALABAMA-COOSA BASIN
WATER CONTROL MANUAL

ROBERT F. HENRY LOCK AND DAM

ALABAMA RIVER, ALABAMA

SEDIMENTATION SURVEYS

Comparison of 1974 Original Survey and 1988 Resurvey

NORMAL MONTHLY AND ANNUAL PRECIPITATION IN INCHES
ALABAMA RIVER BASIN ABOVE ROBERT F. HENRY LOCK AND DAM

	ETOWAH RIVER		OOSTANUALA RIVER	COOSA RIVER				TALLAPOOSA RIVER	ALA. RIVER ABOVE R. F. HENRY L & D	ENTIRE BASIN ABOVE R. F. HENRY L & D
	ABOVE ALLATOONA DAM	ALLATOONA DAM TO CONFLUENCE		ABOVE WEISS DAM	WEISS TO HENRY DAM	HENRY TO LOGAN MARTIN DAM	LOGAN MARTIN TO CONFLUENCE			
NO. OF STATIONS	5	4	8	4	2	3	5	7	2	40
January	5.74	4.90	5.34	5.25	5.36	5.28	5.32	5.39	4.89	5.27
February	5.31	4.76	5.12	5.05	5.11	5.30	5.36	5.32	5.23	5.17
March	6.57	6.12	6.19	6.38	6.59	6.62	6.43	6.53	6.29	6.41
April	5.22	5.00	4.70	4.61	5.53	5.10	5.11	5.08	4.69	5.00
May	4.7	4.29	4.71	4.49	4.52	4.23	3.93	4.51	3.83	4.35
June	4.02	3.66	4.06	4.00	3.68	4.18	3.89	4.16	3.85	3.94
July	4.91	4.69	4.98	4.69	5.01	4.90	4.79	5.00	5.04	4.89
August	4.3	3.56	3.73	3.50	3.40	3.86	3.92	3.86	3.77	3.76
September	3.94	3.67	4.25	4.27	3.73	3.87	3.91	3.69	4.01	3.92
October	3.72	2.93	3.56	3.31	3.00	2.84	2.84	3.24	2.64	3.12
November	4.16	3.83	4.42	4.26	4.14	4.04	4.03	4.10	3.94	4.10
December	5.07	4.63	5.03	5.18	5.48	5.14	5.41	5.21	5.08	5.13
Annual	57.66	52.04	56.09	54.99	55.55	55.36	54.94	56.09	53.26	55.06

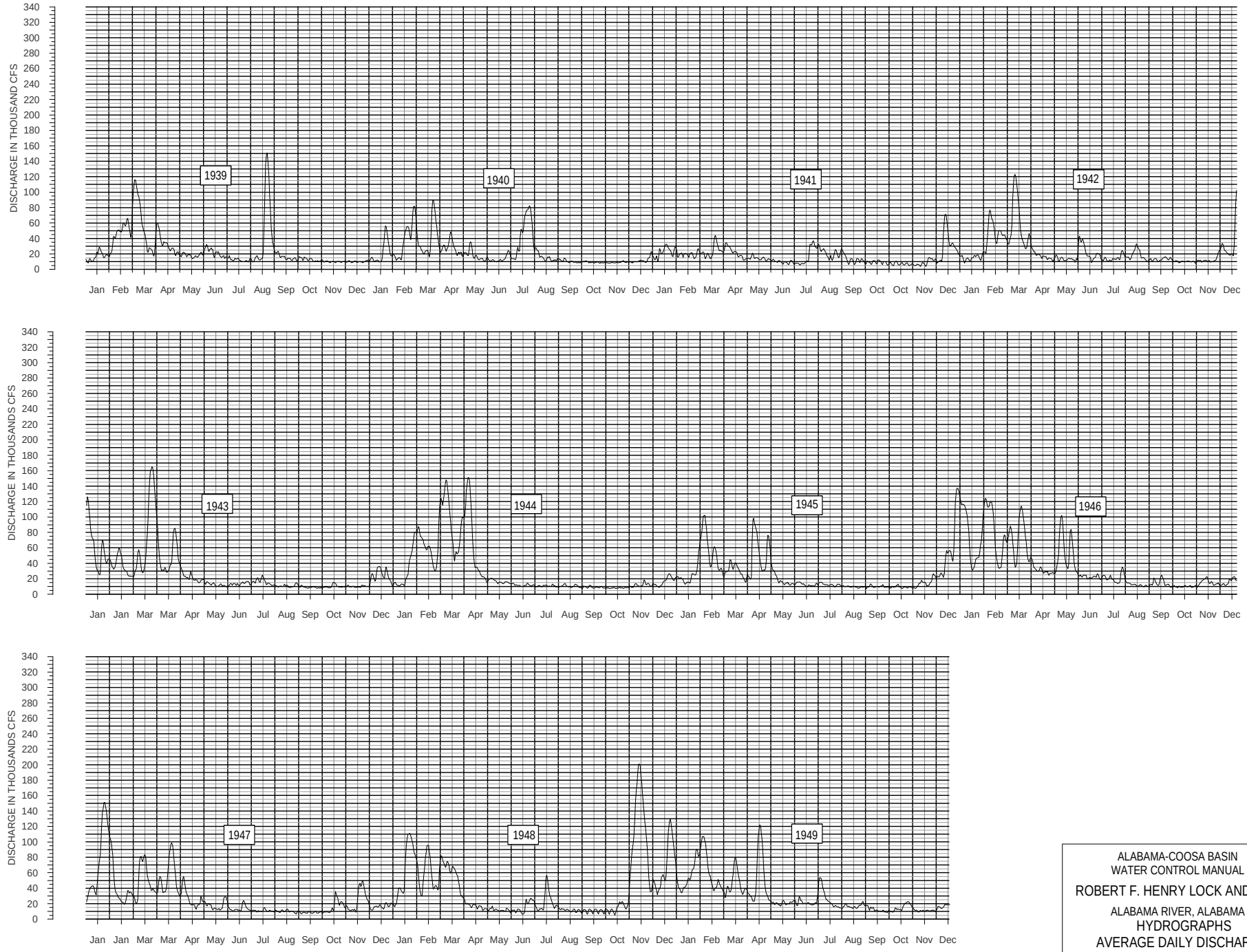
(1) Based on normals for the period 1961-90 by the National Weather Service.

ALABAMA-COOSA RIVER BASIN WATER CONTROL MANUAL

ROBERT F. HENRY L&D

ALABAMA RIVER, ALABAMA

NORMAL MONTHLY AND ANNUAL PRECIPITATION

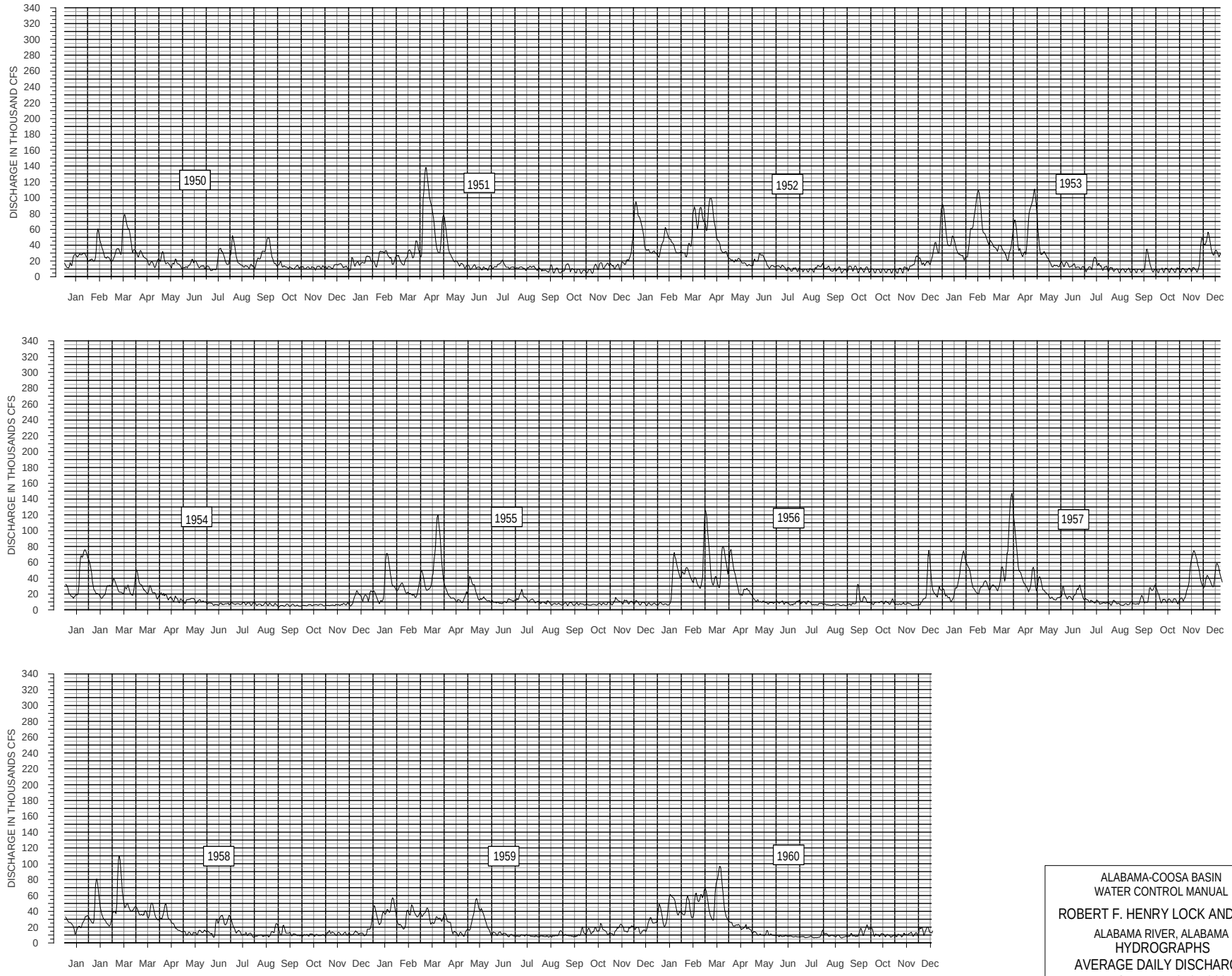


ALABAMA-COOSA BASIN
WATER CONTROL MANUAL

ROBERT F. HENRY LOCK AND DAM

ALABAMA RIVER, ALABAMA

HYDROGRAPHS
AVERAGE DAILY DISCHARGE
AT SELMA 1939-1949

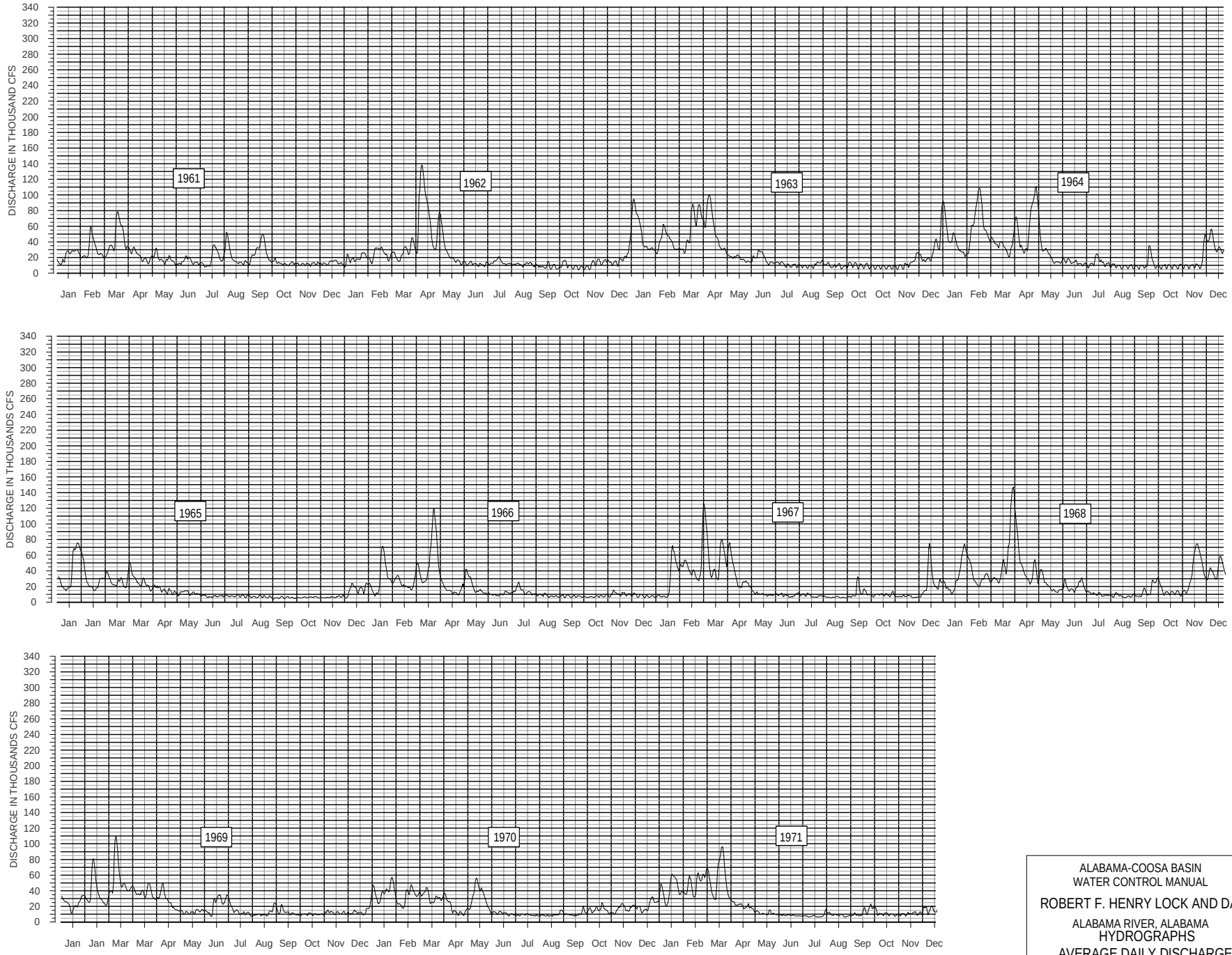


ALABAMA-COOSA BASIN
WATER CONTROL MANUAL

ROBERT F. HENRY LOCK AND DAM

ALABAMA RIVER, ALABAMA

HYDROGRAPHS
AVERAGE DAILY DISCHARGE
AT SELMA 1950-1960



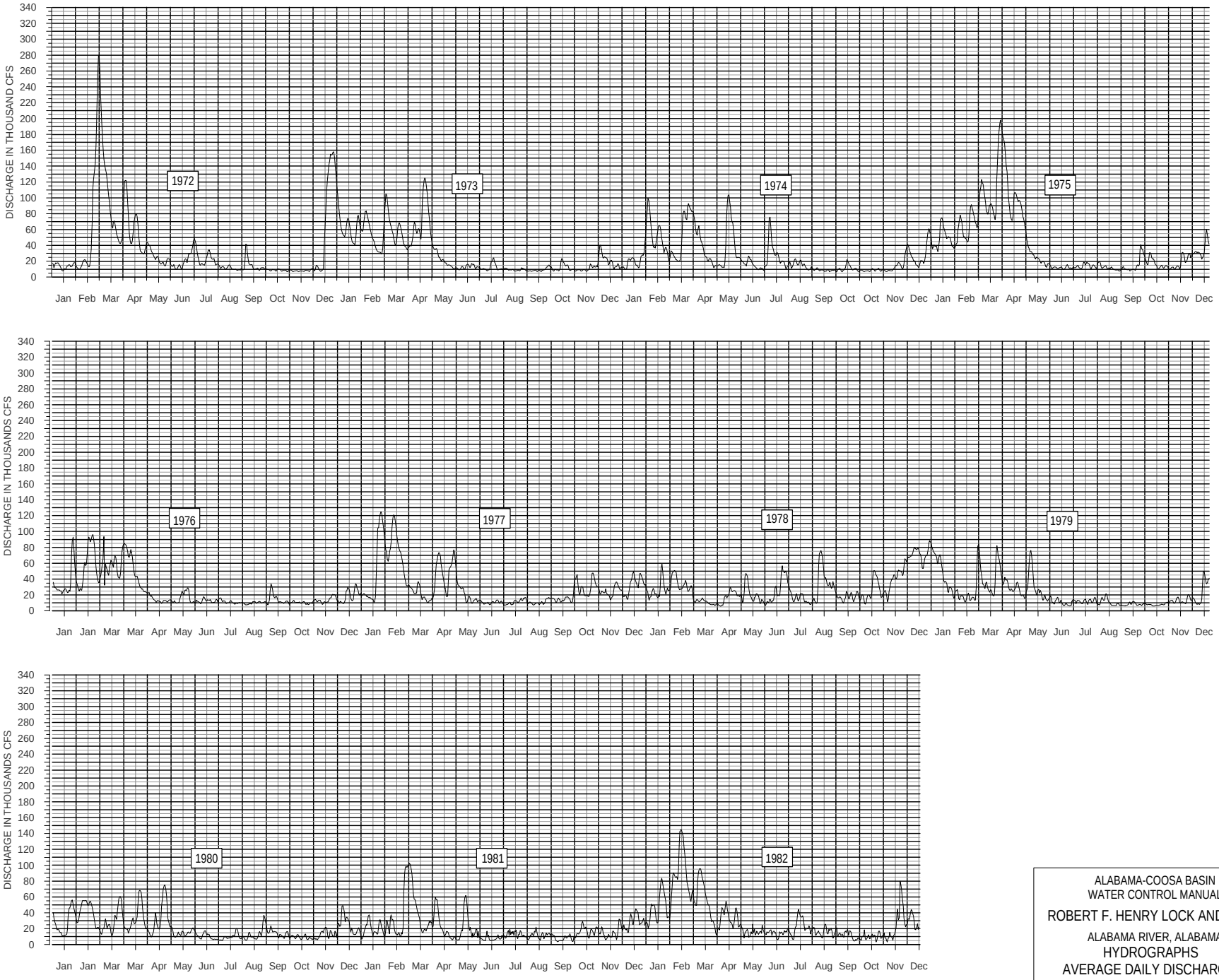
ALABAMA-COOSA BASIN
WATER CONTROL MANUAL

ROBERT F. HENRY LOCK AND DAM

ALABAMA RIVER, ALABAMA

HYDROGRAPHS

AVERAGE DAILY DISCHARGE
AT SELMA 1961-1971

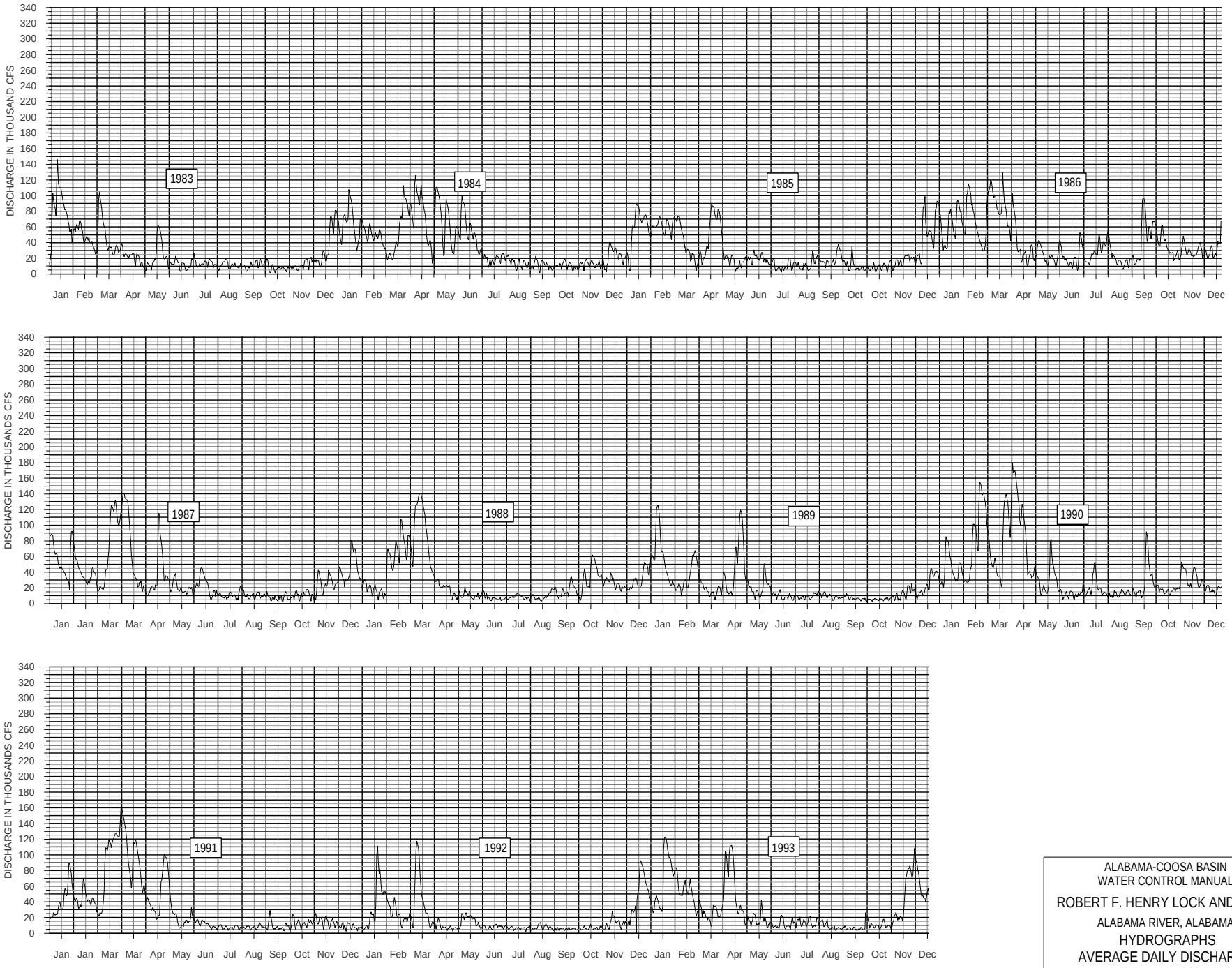


ALABAMA-COOSA BASIN
WATER CONTROL MANUAL

ROBERT F. HENRY LOCK AND DAM

ALABAMA RIVER, ALABAMA

HYDROGRAPHS
AVERAGE DAILY DISCHARGE
AT SELMA 1972-1982



ALABAMA-COOSA BASIN
WATER CONTROL MANUAL

ROBERT F. HENRY LOCK AND DAM

ALABAMA RIVER, ALABAMA

HYDROGRAPHS
AVERAGE DAILY DISCHARGE
AT SELMA 1983-1993

Alabama River near Robert F. Henry Lock and Dam*
Mean Monthly and Annual Flows (1929-1950)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Monthly Min	Monthly Max	Yearly Min	Yearly Max
1929	18600	33400	149000	41200	60600	21900	17200	12700	11700	13400	78900	33100	40975	11700	149000	6240	204000
1930	30400	41400	49300	25100	18200	9680	9780	10800	12600	12600	24700	13500	21505	9680	49300	7340	161000
1931	20600	18700	18900	29400	15100	10600	7950	8420	7380	6720	6050	27200	14751	6050	29400	5560	68000
1932	39500	67800	27900	32700	23800	14300	22100	15100	11000	13400	20500	76800	30408	11000	76800	6840	158000
1933	76500	59600	56400	43600	21800	13600	13300	11400	11700	10530	10550	9473	28204	9473	76500	7910	162000
1934	15100	10870	46580	14540	11190	17590	11380	153200	11990	31760	15610	15280	18125	10870	46580	6970	107000
1935	24510	27800	55270	42120	25170	15880	11310	13200	11400	8274	11290	13040	21605	8274	55270	7000	92300
1936	88790	93800	32430	93690	18840	11020	9549	14640	10290	12820	10020	17860	34479	9549	93800	7470	177000
1937	79510	50850	43460	41070	56300	16370	12420	10980	14720	14480	15390	13560	30759	10980	79510	8090	117000
1938	15330	12800	38770	107400	19370	15280	25610	21360	12190	8926	9012	9172	24601	8926	107400	7670	190000
1939	16620	47920	58370	32210	18380	21320	12180	47770	15180	12140	9985	10630	35225	9985	58370	8390	151000
1940	21620	43330	38110	26230	16400	14170	46240	13050	9663	8729	9313	14500	21779	8729	46240	7800	9000
1941	23150	19580	26860	16910	12480	8187	23950	16920	9955	8215	6495	23170	16322	6495	26860	3940	71400
1942	19910	35150	61520	28080	14000	21160	14160	19960	12750	11620	10510	26930	22979	10510	61520	7940	123000
1943	60490	36600	78470	47880	20970	12150	13770	15510	10740	8776	10370	11930	27304	8776	78470	7510	165000
1944	22540	44720	72970	95690	39650	14740	11120	10880	9679	8518	9044	11920	29289	8518	95690	7080	151000
1945	19780	49810	38380	39130	40370	13950	12190	10860	9448	9842	10530	26330	23385	9448	49810	7220	102000
1946	88750	86190	61340	52600	44340	34200	21250	16470	14170	10180	14330	14970	38232	10180	88750	8250	137000
1947	78960	37790	49780	54770	26550	17530	13430	10720	9717	8503	17060	24140	29079	8503	78960	6660	151000
1948	18070	70780	62420	48120	15120	11090	16200	22150	10640	10600	48660	91300	35429	10600	91300	5050	201000
1949	67890	78300	42070	42880	46630	21920	28270	16560	15690	10770	14750	13990	33310	10770	78300	8230	130000
1950	22490	30470	43230	22350	18010	14880	19920	19320	27770	12470	11820	13850	21381	11820	43230	7710	78400

*USGS gage at Selma, AL 30.65 miles downstream from damsite.

ALABAMA-COOSA RIVER BASIN
WATER CONTROL MANUAL
ROBERT F. HENRY L&D
ALABAMA RIVER, ALABAMA
MEAN MONTHLY AND ANNUAL FLOWS (1929-1950)

Alabama River near Robert F. Henry Lock and Dam*
Mean Monthly and Annual Flows (1951-1970)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Monthly Min	Monthly Max	Yearly Min	Yearly Max
1951	18930	26460	33680	74360	17880	11880	13580	10640	9427	7570	14090	41540	23336	7570	74360	4120	138000
1952	38050	37130	74590	33020	19470	15110	9239	11070	9651	8646	8414	17600	23499	8414	74590	4670	100000
1953	50180	49820	48940	38060	54400	14810	13570	9821	11070	9843	9013	34310	28653	9013	54400	5120	111000
1954	41070	26670	27710	26320	14970	11370	7520	7655	6416	5602	6015	6572	15657	5602	41070	3510	75800
1955	18260	35830	27530	51700	19270	13960	12370	11700	7771	6999	8633	9608	18635	6999	51700	5200	120000
1956	7253	44440	54150	51740	17350	9182	8865	6640	9656	10220	8434	19710	20636	6640	54150	5020	126000
1957	20920	43800	33350	70820	29080	17230	14340	8079	10510	17230	34090	40550	28333	8079	70820	5540	147000
1958	24930	38330	54460	37520	26360	13120	23820	12020	12490	11810	10300	11640	23066	10300	54460	7200	110000
1959	20650	36790	34360	31480	16240	28860	10240	8730	9911	12210	15400	18150	20251	8730	36790	7200	57400
1960	28360	47020	49820	45980	15180	9870	7820	9210	8900	13870	9638	13950	21634	7820	49820	6360	96800
1961	14330	63910	106000	62690	24640	21870	22380	11000	15050	8660	8524	85590	37053	8524	106000	7060	279000
1962	60570	56630	51530	69820	17070	13380	12750	8952	9944	11820	17280	15830	28798	8952	69820	7110	125000
1963	39520	37960	62860	19990	43180	23340	19650	12200	8915	10260	8979	21590	25703	8915	62860	6820	104000
1964	42430	52080	85460	123800	55490	14180	13490	13590	9650	21760	15060	31830	39901	9650	123800	7680	198000
1965	36360	58640	57510	49240	13790	16070	12840	10540	9852	14530	10600	13440	35284	9852	58640	7470	96000
1966	20710	60110	66710	22160	48850	14820	9868	11400	12180	21020	27490	23620	28244	9868	66710	7250	125000
1967	32830	34160	23400	9841	24700	13430	29040	24560	26470	17300	31940	62450	27510	9841	62450	5780	79800
1968	67940	22610	33090	39020	33060	14200	10300	12660	8131	8463	12240	22700	23701	8131	67940	5770	88300
1969	30450	46750	32800	34340	34050	15620	11460	11290	15390	14220	10790	18650	22984	10790	46750	5520	89000
1970	25770	23810	49280	33730	15070	21630	10410	13840	13750								
Average	35919	43824	51399	45316	26746	15844	15400	13809	11797	11836	15654	24926					

*USGS gage at Selma, AL 30.65 miles downstream from damsite.

ALABAMA-COOSA RIVER BASIN
WATER CONTROL MANUAL
ROBERT F. HENRY L&D
ALABAMA RIVER, ALABAMA
MEAN MONTHLY AND ANNUAL FLOWS (1951-1970)

Alabama River near Robert F. Henry Lock and Dam*
Mean Monthly and Annual Flows (1975-1996)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Monthly Min	Monthly Max	Yearly Min	Yearly Max
1975							24114	27282	35988	46355	26106	29024					
1976	58293	35275	68404	52736	35726	19082	21712	10607	9613	7004	11619	27206	29773	7004	68404	2742	125749
1977	36989	21521	69638	71182	13832	10227	5883	7856	11073	21145	36866	23021	27436	5883	71182	1484	120206
1978	52948	33102	34425	15270	40289	16100	6986	10430	6558	5241	6732	13638	20143	5241	52948	138	106931
1979	38811	41191	71396	103079	28555	21948	17679	12885	18590	19857	29914	19451	35280	12885	103079	1871	194130
1980	36332	36718	89236	81159	48553	15985	10340	6507	6036	11043	12756	12467	30594	6036	89236	1657	129580
1981	7681	41646	20453	32986	8016	13010	7415	5588	7192	5515	6911	17071	14457	5515	41646	1735	106698
1982	52573	75315	37471	49540	24771	13266	12152	11153	5914	9749	15714	68886	31375	5914	75315	2507	122696
1983	38652	55013	53233	70686	37742	19129	11385	7487	9811	7929	26912	77552	34628	7487	77552	1737	131798
1984	52054	33839	36742	35253	42568	11380	13749	35672	8965	9351	12366	19530	25956	8965	52054	2227	125081
1985	14207	48176	17244	9993	13224	6398	15312	13054	6698	10184	12501	17711	15392	6398	48176	1152	109878
1986	10075	17984	20810	6801	4926	4822	5256	4832	4122	3917	20637	27080	10939	3917	27080	1463	71673
1987	41534	42313	54395	17211	9998	11779	10743	5550	5349	5359	5506	8590	18194	5349	54395	1162	122946
1988	25926	22480	11406	11201	6134	5418	4778	4303	15513	9553	19826	12859	12450	4303	25926	2174	71391
1989	35099	21243	52866	42791	16500	53837	42356	11983	12958	30674	28717	35812	32070	11983	53837	3833	139177
1990	62514	112455	105496	25815	19881	8942	8667	6966	5558	7767	9222	17860	32595	5558	112455	3601	218355
1991	22135	36677	39848	32001	46882	19873	15268	10525	10049	7957	15242	22437	23241	7957	46882	4831	99896
1992	34864	42235	38781	19557	8226	14396	9850	14631	15355	10682	49969	56644	26266	8226	56644	5207	115000
1993	64255	38953	45670	31262	17909	9398	8054	7130	5826	5529	9486	16642	21676	5529	64255	4128	110372
1994	23501	38913	43434	49563	13840	12484	33684	16110	13285	22569	16341	36159	26657	12484	49563	3933	104870
1995	26391	50453	57509	14764	9992	7083	6251	5667	5538	45455	42056	36176	25611	5538	57509	6318	149436
1996	48488	73305	79036	31858	16347	13348	9449	10127	12887								
Average	37301	43753	49881	38319	22091	14662	13686	11198	10585	14421	19781	28372	25035	7988	61524	2695	123793

*Robert F. Henry project discharge data.

ALABAMA-COOSA RIVER BASIN
WATER CONTROL MANUAL
ROBERT F. HENRY L&D
ALABAMA RIVER, ALABAMA
MEAN MONTHLY AND ANNUAL FLOWS (1975-1996)

▪ RAINFALL STATION

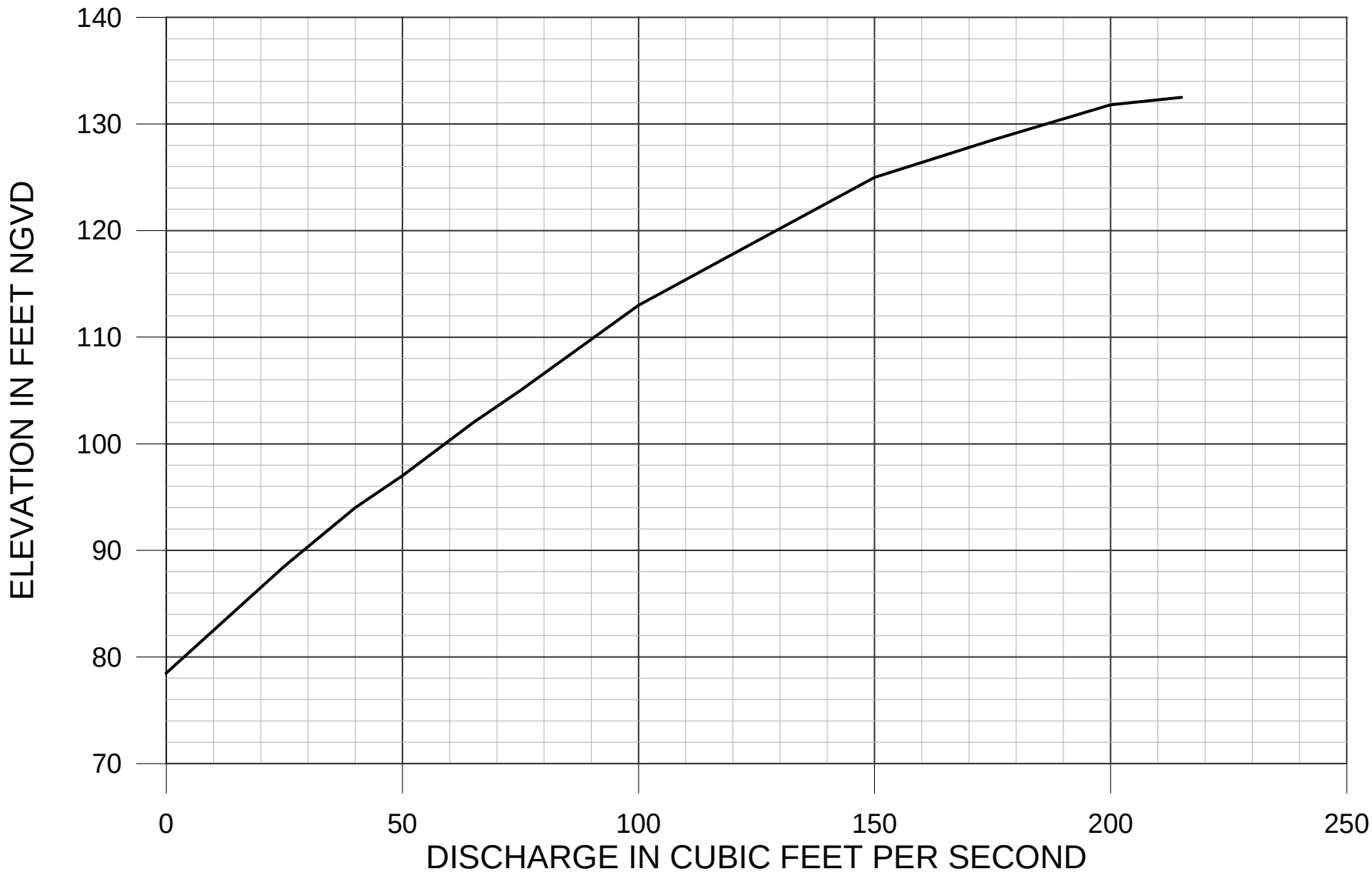
◉ RAINFALL AND RIVER STAGE

○ RIVER STAGE

ALABAMA – COOSA BASIN
WATER CONTROL MANUAL

ROBERT F. HENRY L & D
ALABAMA RIVER, ALABAMA

RAINFALL AND RIVER STAGE
REPORTING NETWORK



ALABAMA-COOSA BASIN
WATER CONTROL MANUAL
ROBERT F. HENRY L&D

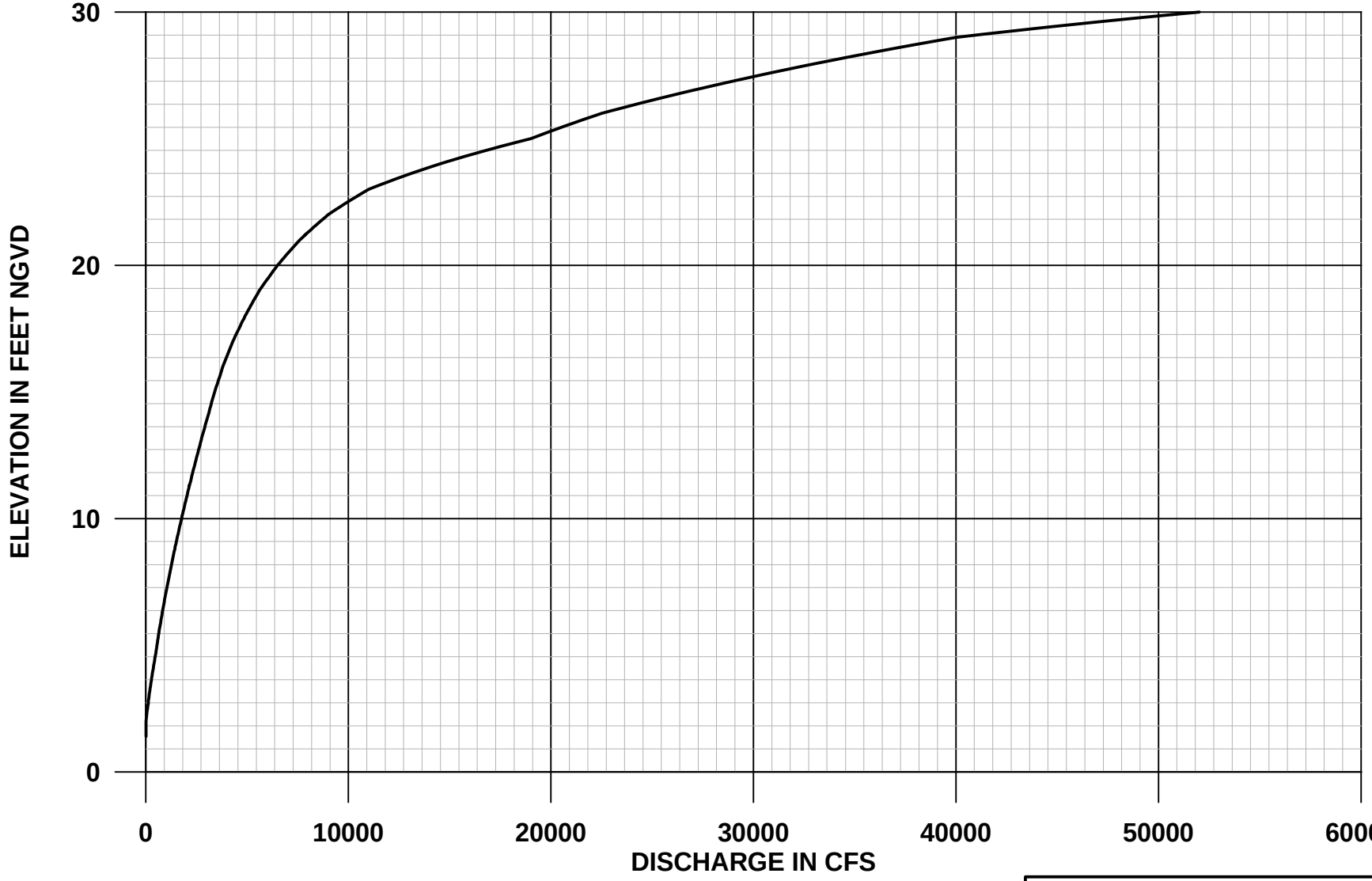
ALABAMA RIVER, ALABAMA

TAILWATER RATING CURVE

CORPS OF ENGINEERS

U.S. ARMY

APPENDIX G PLATE NO. 5-2



Gage Zero Elevation is 151.02 feet NGVD

ALABAMA-COOSA BASIN
WATER CONTROL MANUAL

ROBERT F. HENRY LOCK AND DAM
ALABAMA RIVER, ALABAMA

RATING CURVE FOR
CATOMA CREEK NEAR
MONTGOMERY, AL
Station No. 02421000

CORPS OF ENGINEERS

U.S. ARMY

APPENDIX G PLATE NO. 5-3

NWS Form 612-20

U. S. Department of Commerce -- National Weather Service

REPORTING INSTRUCTIONS

RAINFALL STATION

TIMES OF OBSERVATION

1. Your regular daily observation of precipitation should be taken at 7 a.m. each day. (EMPTY NON-RECORDING RAIN GAGE AFTER EACH 7 A.M. OBSERVATION.)

2. Special observations when made should be taken at 1 p.m., and 7 p.m. These special observations should be taken ONLY when a report is required in accordance with instructions (see below).

WHEN TO REPORT

1. Make an initial report at 7 a.m., 1 p.m., or 7 p.m., whenever 0.50 or more of precipitation has accumulated in the rain gage.
2. After the first report has been made CONTINUE REPORTING AT EACH OBSERVATION TIME (1 p.m., 7 p.m., 7 a.m.) as long as any additional precipitation has occurred since your previous report.
3. If you have made a final report, but it begins to rain again in less than 24 hours start reporting again, just as though you had not stopped. That is, you should not consider the storm to be over until there has been no precipitation for 24 hours.

WHAT TO REPORT

Your report should include the following information in the order listed (Numbers refer to NWS Form 1089):

(1) Time of observation (hour).

(2) Amount of precipitation in gage at time of observation, in figures (inches and hundredths).

(3) Character of precipitation as it fell (rain, snow, sleet, etc.).

(4) Amount of precipitation measured at PREVIOUS 7 A.M. OBSERVATION, in figures (inches and hundredths). This information should be sent ONLY in your first report of a series of reports. The amount when sent, should always be preceded by "previous 7 a.m." In subsequent reports omit this section entirely.

(5) Weather at time of observation (clear, cloudy, raining, snowing, etc.).

(6) Depth of snow or ice on ground, in figures (nearest inch). The figure showing depth should always be followed by the word "Inch" or "Inches." If there is no snow on the ground omit this section entirely.

(7) Remarks. Any general comments which you feel would be of real value to the forecaster, such as: If snow is melting state whether slowly or rapidly. If thunderstorm or unusually heavy shower occurred within short period of time, give time of beginning and ending, etc. If instructed, include temperature readings.

(8) Last name of observer.

PREPARATION ON REPORT

1. The special River Rainfall Report card (NWS Form 1089) furnished will assist you in arranging your report in the proper order. This form has numbered blocks for each of the items to be reported by river and rainfall observers.
2. You should enter the designated information in blocks 1 through 6, 12, and 13. Each report must be complete. our report will then be ready for transmission in message form as follows (Indicate on card whether report has been telephoned, faxed, or e-mailed).

Sample messages:

(First of a series) -- "7 A.M. 0.75 SNOW PREVIOUS 7 A.M. 0.25 CLOUDY 6 INCHES MELTING RAPIDLY
JONES"

(Subsequent reports) -- "1 P.M. 0.30 RAIN CLOUDY 4 INCHES MELTING RAPIDLY
JONES"

"7 P.M. 1.20 SHOWERS CLEAR THUNDERSTORM 4 P.M.
JONES"

SENDING THE REPORT

1. If you report by e-mail address message to: _____

2. If you report by telephone or fax, call: _____

3. All messages should be sent COLLECT.

4. In an emergency, when all lines of communication are out, contact our local or state police who may be able o transmit your report by police radio.

NOTES

1. Promptly after each observation, mail the River Rainfall Report card which you have filled out to _____
_____
_____
_____

2. When additional supplies are needed, notify
_____
_____
_____
_____
_____
_____
_____

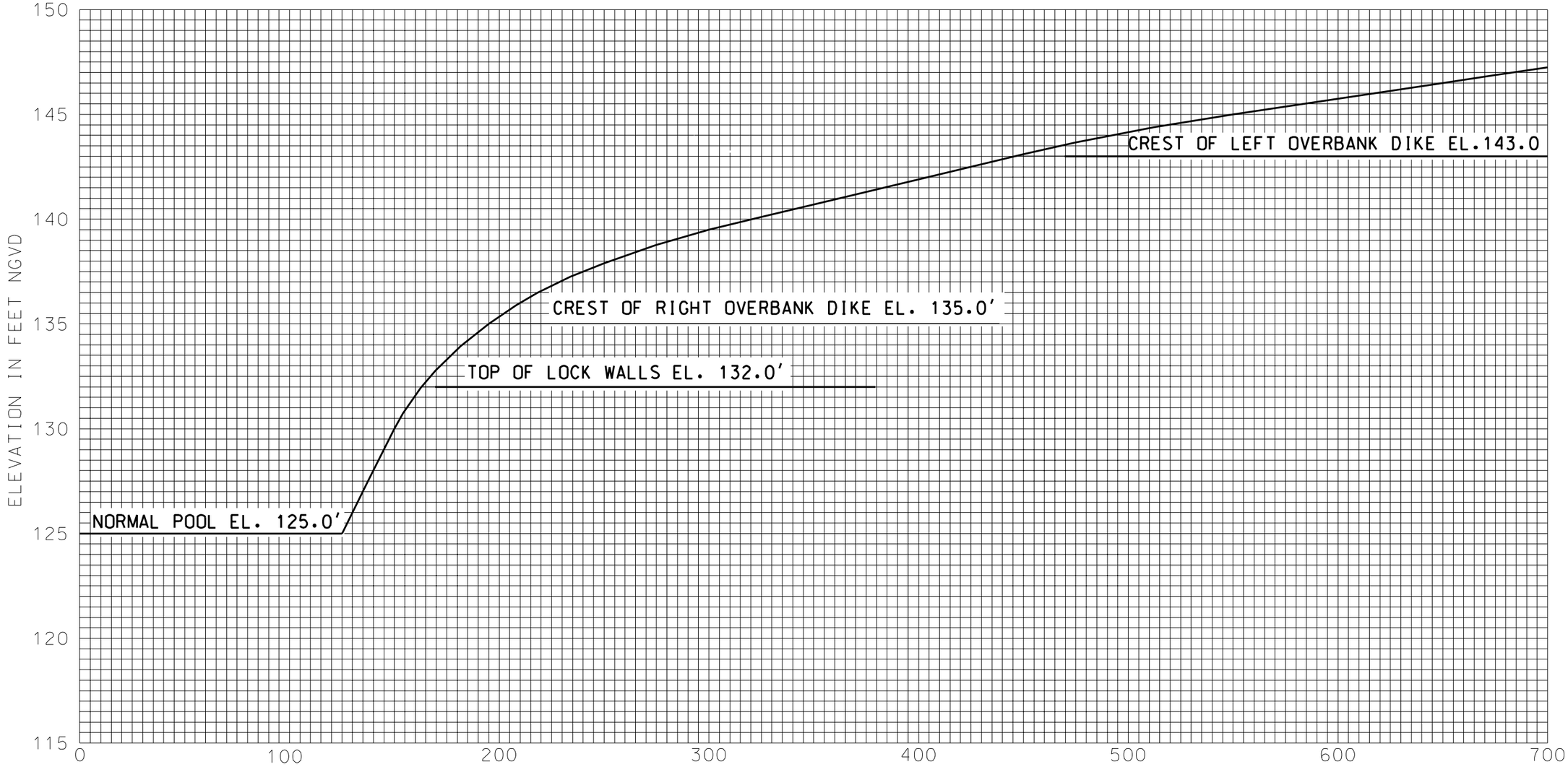
3. SPECIAL INSTRUCTIONS: _____
_____
_____

ALABAMA-COOSA-TALLAPOOSA
RIVER BASIN

ROBERT F. HENRY LOCK AND DAM

ALABAMA RIVER, ALABAMA

NWS RAINFALL STATION REPORTING INSTRUCTIONS

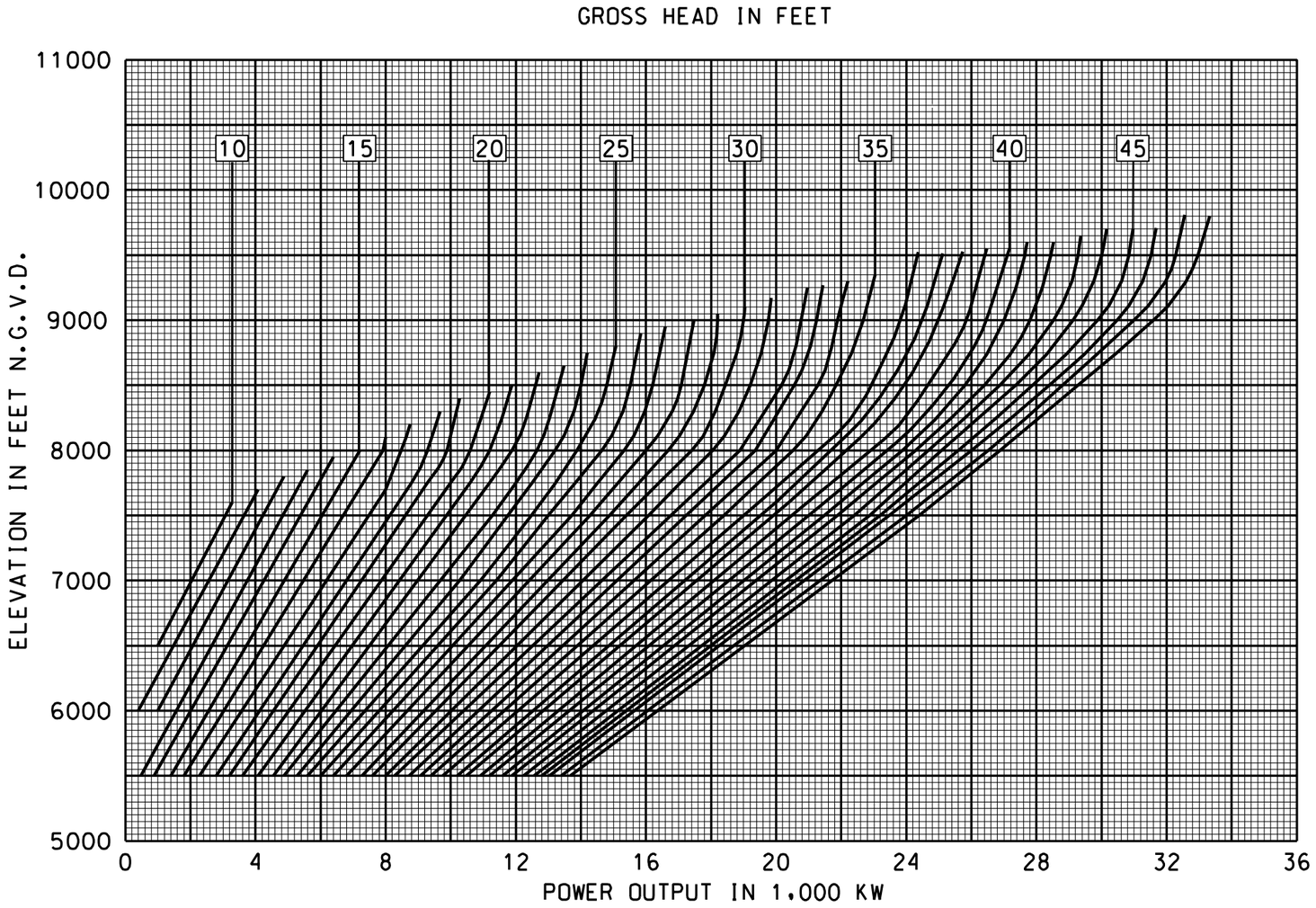


ALABAMA - COOSA BASIN
WATER CONTROL MANUAL

ROBERT F. HENRY L & D
ALABAMA RIVER, ALABAMA

DISCHARGE CURVE SPILLWAY
LOCK AND OVERBANK DIKES

APPENDIX G PLATE NO. 7-1



NOTES

1 Based on manufacturer's original performance curves dated June 1967 and manufacturer's calculated generator losses.

2 Maximum and minimum limitation on generating equipment to be determined by field test.

3 Performance curves do not reflect the maintenance and rewinding of the units.

ALABAMA - COOSA BASIN
WATER CONTROL MANUAL

ROBERT F. HENRY L & D
ALABAMA RIVER, ALABAMA

TURBOGENERATOR
PERFORMANCE CURVES

STEP NO.	GATE OPENING SCHEDULE — GATE NUMBER											SPILLWAY DISCHARGE IN CFS — POOL ELEVATION					
	11	10	9	8	7	6	5	4	3	2	1	123.5	124	124.5	125	125.5	126
	OPENING IN RATCHET STEPS																
1	1	C	C	C	C	C	C	C	C	C	C	101	102	103	103	104	105
2	1	1	C	C	C	C	C	C	C	C	C	202	204	205	207	208	210
3	1	1	1	C	C	C	C	C	C	C	C	303	306	308	310	313	315
4	1	1	1	1	C	C	C	C	C	C	C	404	408	411	414	417	420
5	1	1	1	1	1	C	C	C	C	C	C	506	509	513	517	521	525
6	1	1	1	1	1	1	C	C	C	C	C	607	611	616	620	625	630
7	1	1	1	1	1	1	1	C	C	C	C	708	713	719	724	729	734
8	1	1	1	1	1	1	1	1	C	C	C	809	815	821	827	833	839
9	2	1	1	1	1	1	1	1	C	C	C	1416	1427	1437	1448	1459	1469
10	2	2	1	1	1	1	1	1	C	C	C	2023	2038	2054	2069	2084	2099
11	2	2	2	1	1	1	1	1	C	C	C	2630	2650	2670	2690	2709	2729
12	2	2	2	2	1	1	1	1	C	C	C	3236	3261	3286	3310	3335	3359
13	2	2	2	2	2	1	1	1	C	C	C	3843	3873	3902	3931	3960	3988
14	2	2	2	2	2	2	1	1	C	C	C	4450	4484	4518	4552	4585	4618
15	2	2	2	2	2	2	2	1	C	C	C	5057	5096	5134	5173	5211	5248
16	2	2	2	2	2	2	2	2	C	C	C	5664	5708	5751	5793	5836	5878
17	3	2	2	2	2	2	2	2	C	C	C	6996	7050	7103	7156	7208	7260
18	3	3	2	2	2	2	2	2	C	C	C	8328	8392	8456	8519	8581	8643
19	3	3	3	2	2	2	2	2	C	C	C	9661	9735	9808	9881	9953	10025
20	3	3	3	3	2	2	2	2	C	C	C	10993	11077	11161	11244	11326	11408
21	3	3	3	3	3	2	2	2	C	C	C	12325	12419	12513	12606	12699	12790
22	3	3	3	3	3	3	2	2	C	C	C	13657	13762	13866	13969	14071	14173
23	3	3	3	3	3	3	3	2	C	C	C	14989	15104	15218	15331	15444	15555
24	3	3	3	3	3	3	3	3	C	C	C	16322	16447	16571	16694	16816	16938

ALABAMA-COOSA BASIN
WATER CONTROL MANUAL
ROBERT F. HENRY LOCK AND DAM
ALABAMA RIVER, ALABAMA
SPILLWAY GATE OPERATION SCHEDULE

STEP NO.	GATE OPENING SCHEDULE — GATE NUMBER											SPILLWAY DISCHARGE IN CFS — GROSS HEAD														
	11	10	9	8	7	6	5	4	3	2	1	44.0	42.0	40.0	38.0	36.0	34.0	32.0	30.0	28.0	26.0	24.0	22.0	20.0	18.0	16.0
	OPENING IN RATCHET STEPS																									
25	4	3	3	3	3	3	3	3	C	C	C	20157	19693	19219	18732	18233	17719	17190	16644	16080	15495					
26	4	4	3	3	3	3	3	3	C	C	C	21196	20709	20210	19698	19173	18632	18076	17502	16909	16294					
27	4	4	4	3	3	3	3	3	C	C	C	22235	21724	21201	20664	20113	19546	18962	18360	17738	17093					
28	4	4	4	4	3	3	3	3	C	C	C	23275	22740	22192	21630	21053	20460	19849	19218	18567	17891					
29	4	4	4	4	4	3	3	3	C	C	C	24314	23755	23183	22596	21993	21373	20735	20077	19396	18690					
30	4	4	4	4	4	4	3	3	C	C	C	25353	24770	24173	23561	22933	22287	21621	20935	20225	19489					
31	4	4	4	4	4	4	4	3	C	C	C			25164	24527	23873	23200	22508	21793	21054	20288	19492	18662			
32	4	4	4	4	4	4	4	4	C	C	C			26155	25493	24813	24114	23394	22651	21883	21087	20260	19397			
33	5	4	4	4	4	4	4	4	C	C	C			27112	26425	25721	24996	24250	23480	22683	21858	21001	20107			
34	5	5	4	4	4	4	4	4	C	C	C			28068	27358	26628	25878	25105	24308	23484	22629	21742	20816			
35	5	5	5	4	4	4	4	4	C	C	C			29025	28290	27535	26759	25961	25136	24284	23400	22482	21525			
36	5	5	5	5	4	4	4	4	C	C	C			29981	29222	28443	27641	26816	25964	25084	24172	23223	22235			
37	5	5	5	5	5	4	4	4	C	C	C			30938	30154	29350	28523	27671	26793	25884	24943	23964	22944			
38	5	5	5	5	5	5	4	4	C	C	C			31894	31087	30257	29405	28527	27621	26685	25714	24705	23653			
39	5	5	5	5	5	5	5	4	C	C	C			32851	32019	31165	30287	29382	28449	27485	26485	25446	24363			
40	5	5	5	5	5	5	5	5	C	C	C			33807	32951	32072	31169	30238	29278	28285	27256	26187	25072			
41	5	5	5	5	5	5	5	5	1	C	C								29718	28384	27317	26228	25101	23926	22694	21393
42	5	5	5	5	5	5	5	5	2	C	C								30441	29808	28275	26929	25643	24362	23055	21699
43	5	5	5	5	5	5	5	5	3	C	C								31251	30191	29093	27952	26762	25516	24207	22822
44	5	5	5	5	5	5	5	5	4	C	C								32109	31020	29892	28719	27497	26217	24872	23449
45	5	5	5	5	5	5	5	5	5	C	C								32937	31821	30663	29460	28206	26893	25513	24054
46	5	5	5	5	5	5	5	5	5	1	C								33377	31919	30724	29501	28235	26914	25529	24066
47	5	5	5	5	5	5	5	5	5	2	C								34100	33344	31682	30202	28777	27351	25890	24371
48	5	5	5	5	5	5	5	5	5	3	C								34911	33727	32500	31225	29896	28504	27042	25495
49	5	5	5	5	5	5	5	5	5	4	C								35769	34556	33299	31993	30631	29205	27706	26122
50	5	5	5	5	5	5	5	5	5	5	C								36597	35356	34070	32733	31340	29881	28348	26727
51	5	5	5	5	5	5	5	5	5	5	1								37037	35455	34131	32775	31369	29903	28364	26739
52	5	5	5	5	5	5	5	5	5	5	2								37760	36880	35089	33476	31911	30339	28725	27044
53	5	5	5	5	5	5	5	5	5	5	3								38570	37263	35907	34498	33030	31493	29876	28168
54	5	5	5	5	5	5	5	5	5	5	4								39429	38092	36706	35266	33765	32193	30541	28795
55	5	5	5	5	5	5	5	5	5	5	5								40257	38892	37477	36007	34474	32870	31183	29399
56	6	5	5	5	5	5	5	5	5	5	5								41123	39729	38283	36782	35216	33577	31854	30032
57	6	6	5	5	5	5	5	5	5	5	5								41989	40565	39090	37556	35957	34284	32525	30665
58	6	6	6	5	5	5	5	5	5	5	5								42855	41402	39896	38331	36699	34991	33196	31297
59	6	6	6	6	5	5	5	5	5	5	5								43721	42239	40702	39106	37441	35698	33866	31930
60	6	6	6	6	6	5	5	5	5	5	5								44588	43076	41509	39880	38183	36406	34537	32562
61	6	6	6	6	6	6	5	5	5	5	5								45454	43912	42315	40655	38924	37113	35208	33195
62	6	6	6	6	6	6	6	5	5	5	5								46320	44749	43121	41430	39666	37820	35879	33827
63	6	6	6	6	6	6	6	6	5	5	5								47186	45586	43928	42204	40408	38527	36550	34460
64	6	6	6	6	6	6	6	6	6	5	5								48052	46423	44734	42979	41149	39234	37221	35092
65	6	6	6	6	6	6	6	6	6	6	5								48918	47260	45540	43754	41891	39942	37892	35725
66	6	6	6	6	6	6	6	6	6	6	6								49784	48096	46347	44529	42633	40649	38563	36357

ALABAMA-COOSA BASIN
WATER CONTROL MANUAL
ROBERT F. HENRY LOCK AND DAM
ALABAMA RIVER, ALABAMA
SPILLWAY GATE OPERATION SCHEDULE

STEP NO.	GATE OPENING SCHEDULE — GATE NUMBER											SPILLWAY DISCHARGE IN CFS — GROSS HEAD												
	11	10	9	8	7	6	5	4	3	2	1	30.0	28.0	26.0	24.0	22.0	20.0	18.0	16.0	14.0	12.0	10.0	8.0	6.0	4.0
	OPENING IN RATCHET STEPS																								
67	7	6	6	6	6	6	6	6	6	6	6	50651	48933	47153	45303	43375	41356	39234	36990						
68	7	7	6	6	6	6	6	6	6	6	6	51517	49770	47959	46078	44116	42063	39905	37623						
69	7	7	7	6	6	6	6	6	6	6	6	52383	50607	48766	46853	44858	42770	40576	38255						
70	7	7	7	7	6	6	6	6	6	6	6	53249	51443	49572	47627	45600	43478	41247	38888						
71	7	7	7	7	7	6	6	6	6	6	6	54115	52280	50379	48402	46341	44185	41917	39520						
72	7	7	7	7	7	7	6	6	6	6	6	54981	53117	51185	49177	47083	44892	42588	40153						
73	7	7	7	7	7	7	7	6	6	6	6	55847	53954	51991	49952	47825	45599	43259	40785						
74	7	7	7	7	7	7	7	7	6	6	6	56714	54791	52798	50726	48567	46306	43930	41418						
75	7	7	7	7	7	7	7	7	7	6	6	57580	55627	53604	51501	49308	47014	44601	42050						
76	7	7	7	7	7	7	7	7	7	7	6	58446	56464	54410	52276	50050	47721	45272	42683						
77	7	7	7	7	7	7	7	7	7	7	7	59312	57301	55217	53050	50792	48428	45943	43315						
78	8	7	7	7	7	7	7	7	7	7	7	60188	58147	56032	53834	51542	49143	46622	43955						
79	8	8	7	7	7	7	7	7	7	7	7	61064	58994	56848	54618	52292	49859	47300	44595						
80	8	8	8	7	7	7	7	7	7	7	7	61940	59840	57663	55401	53043	50574	47979	45235						
81	8	8	8	8	7	7	7	7	7	7	7	62816	60686	58479	56185	53793	51289	48657	45875						
82	8	8	8	8	8	7	7	7	7	7	7	63693	61533	59295	56968	54543	52005	49336	46514						
83	8	8	8	8	8	8	7	7	7	7	7	64569	62379	60110	57752	55293	52720	50015	47154						
84	8	8	8	8	8	8	8	7	7	7	7	65445	63226	60926	58536	56044	53435	50693	47794						
85	8	8	8	8	8	8	8	8	7	7	7	66321	64072	61741	59319	56794	54151	51372	48434						
86	8	8	8	8	8	8	8	8	8	7	7	67197	64918	62557	60103	57544	54866	52051	49074						
87	8	8	8	8	8	8	8	8	8	8	7	68073	65765	63373	60886	58294	55581	52729	49714						
88	8	8	8	8	8	8	8	8	8	8	8	68949	66611	64188	61670	59045	56297	53408	50353						
89	9	8	8	8	8	8	8	8	8	8	8	69841	67473	65019	62468	59808	57025	54099	51005						
90	9	9	8	8	8	8	8	8	8	8	8	70733	68335	65849	63266	60572	57753	54790	51656						
91	9	9	9	8	8	8	8	8	8	8	8	71625	69197	66680	64064	61336	58482	55481	52308						
92	9	9	9	9	8	8	8	8	8	8	8	72517	70058	67510	64861	62100	59210	56172	52959						
93	9	9	9	9	9	8	8	8	8	8	8	73409	70920	68340	65659	62864	59938	56863	53611						
94	9	9	9	9	9	9	8	8	8	8	8	74301	71782	69171	66457	63628	60667	57554	54262						
95	9	9	9	9	9	9	9	8	8	8	8			70001	67255	64392	61395	58245	54913	51367	47556	43413			
96	9	9	9	9	9	9	9	9	8	8	8			70832	68053	65156	62123	58936	55565	51976	48121	43928			
97	9	9	9	9	9	9	9	9	9	8	8			71662	68851	65920	62852	59626	56216	52586	48685	44443			
98	9	9	9	9	9	9	9	9	9	9	8			72493	69649	66683	63580	60317	56868	53195	49249	44958			
99	9	9	9	9	9	9	9	9	9	9	9			73323	70446	67447	64309	61008	57519	53804	49813	45473			
100	10	9	9	9	9	9	9	9	9	9	9			74150	71241	68208	65034	61696	58168	54411	50375	45986			
101	10	10	9	9	9	9	9	9	9	9	9			74976	72035	68968	65759	62384	58816	55018	50936	46498			
102	10	10	10	9	9	9	9	9	9	9	9			75803	72829	69729	66484	63072	59465	55624	51498	47011			
103	10	10	10	10	9	9	9	9	9	9	9			76630	73624	70489	67209	63760	60113	56231	52060	47524			
104	10	10	10	10	10	9	9	9	9	9	9			77457	74418	71250	67934	64448	60762	56838	52621	48037			
105	10	10	10	10	10	10	9	9	9	9	9			78283	75212	72010	68659	65136	61411	57444	53183	48549			
106	10	10	10	10	10	10	10	9	9	9	9			79110	76007	72771	69384	65824	62059	58051	53745	49062			
107	10	10	10	10	10	10	10	10	9	9	9			79937	76801	73531	70109	66511	62708	58658	54306	49575			
108	10	10	10	10	10	10	10	10	10	9	9			80764	77595	74292	70834	67199	63356	59264	54868	50087			
109	10	10	10	10	10	10	10	10	10	10	9			81590	78389	75052	71559	67887	64005	59871	55430	50600			
110	10	10	10	10	10	10	10	10	10	10	10			82417	79184	75813	72284	68575	64653	60478	55991	51113			

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STEP NO.	GATE OPENING SCHEDULE — GATE NUMBER										
	11	10	9	8	7	6	5	4	3	2	1
	OPENING IN RATCHET STEPS										
111	11	10	10	10	10	10	10	10	10	10	10
112	11	11	10	10	10	10	10	10	10	10	10
113	11	11	11	10	10	10	10	10	10	10	10
114	11	11	11	11	10	10	10	10	10	10	10
115	11	11	11	11	11	10	10	10	10	10	10
116	11	11	11	11	11	11	10	10	10	10	10
117	11	11	11	11	11	11	11	10	10	10	10
118	11	11	11	11	11	11	11	11	10	10	10
119	11	11	11	11	11	11	11	11	11	10	10
120	11	11	11	11	11	11	11	11	11	11	10
121	11	11	11	11	11	11	11	11	11	11	11
122	12	11	11	11	11	11	11	11	11	11	11
123	12	12	11	11	11	11	11	11	11	11	11
124	12	12	12	11	11	11	11	11	11	11	11
125	12	12	12	12	11	11	11	11	11	11	11
126	12	12	12	12	12	11	11	11	11	11	11
127	12	12	12	12	12	12	11	11	11	11	11
128	12	12	12	12	12	12	12	11	11	11	11
129	12	12	12	12	12	12	12	12	11	11	11
130	12	12	12	12	12	12	12	12	12	11	11
131	12	12	12	12	12	12	12	12	12	12	11
132	12	12	12	12	12	12	12	12	12	12	12
133	13	12	12	12	12	12	12	12	12	12	12
134	13	13	12	12	12	12	12	12	12	12	12
135	13	13	13	12	12	12	12	12	12	12	12
136	13	13	13	13	12	12	12	12	12	12	12
137	13	13	13	13	13	12	12	12	12	12	12
138	13	13	13	13	13	13	12	12	12	12	12
139	13	13	13	13	13	13	13	12	12	12	12
140	13	13	13	13	13	13	13	13	12	12	12
141	13	13	13	13	13	13	13	13	13	12	12
142	13	13	13	13	13	13	13	13	13	13	12
143	13	13	13	13	13	13	13	13	13	13	13
144	14	13	13	13	13	13	13	13	13	13	13
145	14	14	13	13	13	13	13	13	13	13	13
146	14	14	14	13	13	13	13	13	13	13	13
147	14	14	14	14	13	13	13	13	13	13	13
148	14	14	14	14	14	13	13	13	13	13	13
149	14	14	14	14	14	14	13	13	13	13	13
150	14	14	14	14	14	14	14	13	13	13	13
151	14	14	14	14	14	14	14	14	13	13	13
152	14	14	14	14	14	14	14	14	14	13	13
153	14	14	14	14	14	14	14	14	14	14	13
154	14	14	14	14	14	14	14	14	14	14	14

STEP NO.	SPILLWAY DISCHARGE IN CFS — GROSS HEAD											
	26.0	24.0	22.0	20.0	18.0	16.0	14.0	12.0	10.0	8.0	6.0	4.0
111	83255	79989	76583	73019	69272	65310	61092	56561	51632			
112	84093	80794	77354	73754	69969	65968	61707	57130	52152			
113	84931	81599	78125	74489	70666	66625	62322	57699	52672			
114	85768	82404	78895	75224	71364	67282	62937	58268	53191			
115	86606	83209	79666	75959	72061	67940	63552	58837	53711			
116	87444	84014	80437	76694	72758	68597	64166	59407	54231			
117	88282	84819	81208	77428	73455	69254	64781	59976	54750			
118	89120	85624	81978	78163	74152	69911	65396	60545	55270			
119	89958	86429	82749	78898	74849	70569	66011	61114	55789			
120	90795	87233	83520	79633	75546	71226	66626	61683	56309			
121	91633	88038	84290	80368	76244	71883	67240	62253	56829			
122					76964	72562	67876	62841	57365	51309	44435	36281
123					77684	73241	68511	63429	57902	51789	44851	36621
124					78404	73920	69146	64017	58439	52270	45267	36960
125					79125	74599	69781	64605	58976	52750	45683	37300
126					79845	75278	70417	65193	59513	53230	46098	37639
127					80565	75958	71052	65781	60050	53710	46514	37979
128					81285	76637	71687	66369	60587	54190	46930	38318
129					82006	77316	72322	66957	61123	54670	47346	38658
130					82726	77995	72957	67545	61660	55151	47762	38997
131					83446	78674	73593	68134	62197	55631	48178	39337
132					84167	79353	74228	68722	62734	56111	48594	39676
133					84888	80033	74864	69311	63272	56592	49010	40017
134					85610	80714	75501	69900	63810	57073	49427	40357
135					86332	81395	76138	70490	64348	57555	49844	40697
136					87054	82075	76774	71079	64886	58036	50261	41038
137					87776	82756	77411	71668	65424	58517	50677	41378
138					88497	83436	78047	72258	65962	58998	51094	41718
139					89219	84117	78684	72847	66500	59479	51511	42058
140					89941	84797	79320	73437	67038	59961	51927	42399
141					90663	85478	79957	74026	67576	60442	52344	42739
142					91385	86158	80594	74615	68114	60923	52761	43079
143					92106	86839	81230	75205	68652	61404	53178	43419
144					92850	87540	81886	75812	69206	61900	53607	43770
145					93593	88241	82541	76419	69760	62395	54036	44120
146					94337	88941	83197	77026	70314	62891	54465	44471
147					95080	89642	83853	77633	70868	63387	54894	44821
148					95823	90343	84508	78240	71423	63882	55324	45172
149					96567	91044	85164	78846	71977	64378	55753	45522
150					97310	91745	85820	79453	72531	64873	56182	45872
151					98054	92446	86475	80060	73085	65369	56611	46223
152					98797	93147	87131	80667	73639	65865	57041	46573
153					99540	93848	87786	81274	74193	66360	57470	46924
154					100284	94549	88442	81881	74747	66856	57899	47274

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ALABAMA RIVER, ALABAMA
SPILLWAY GATE OPERATION SCHEDULE

STEP NO.	GATE OPENING SCHEDULE — GATE NUMBER											SPILLWAY DISCHARGE IN CFS — GROSS HEAD									
	11	10	9	8	7	6	5	4	3	2	1	18.0	16.0	14.0	12.0	10.0	8.0	6.0	4.0	2.0	0.5
	OPENING IN RATCHET STEPS																				
155	15	14	14	14	14	14	14	14	14	14	14	101029	95251	89099	82490	75302	67353	58329	47625		
156	15	15	14	14	14	14	14	14	14	14	14	101774	95953	89756	83098	75858	67849	58759	47977		
157	15	15	15	14	14	14	14	14	14	14	14	102519	96656	90413	83706	76413	68346	59189	48328		
158	15	15	15	15	14	14	14	14	14	14	14	103264	97358	91070	84314	76968	68842	59619	48679		
159	15	15	15	15	15	14	14	14	14	14	14	104009	98060	91727	84923	77523	69339	60049	49030		
160	15	15	15	15	15	15	14	14	14	14	14	104754	98763	92384	85531	78079	69836	60479	49381		
161	15	15	15	15	15	15	15	14	14	14	14	105498	99465	93041	86139	78634	70332	60910	49732		
162	15	15	15	15	15	15	15	15	14	14	14	106243	100167	93698	86747	79189	70829	61340	50084		
163	15	15	15	15	15	15	15	15	15	14	14	106988	100870	94355	87356	79744	71326	61770	50435		
164	15	15	15	15	15	15	15	15	15	15	14	107733	101572	95012	87964	80300	71822	62200	50786		
165	15	15	15	15	15	15	15	15	15	15	15	108478	102274	95669	88572	80855	72319	62630	51137		
166	16	15	15	15	15	15	15	15	15	15	15	109232	102985	96334	89188	81417	72822	63065	51493		
167	16	16	15	15	15	15	15	15	15	15	15	109987	103696	96999	89804	81979	73324	63501	51848		
168	16	16	16	15	15	15	15	15	15	15	15	110741	104407	97664	90420	82541	73827	63936	52204		
169	16	16	16	16	15	15	15	15	15	15	15	111495	105119	98329	91035	83104	74330	64372	52559		
170	16	16	16	16	16	15	15	15	15	15	15	112249	105830	98995	91651	83666	74833	64807	52915		
171	16	16	16	16	16	16	15	15	15	15	15	113003	106541	99660	92267	84228	75336	65243	53270		
172	16	16	16	16	16	16	16	15	15	15	15	113758	107252	100325	92883	84790	75838	65678	53626		
173	16	16	16	16	16	16	16	16	15	15	15	114512	107963	100990	93499	85352	76341	66113	53981		
174	16	16	16	16	16	16	16	16	16	15	15	115266	108674	101655	94114	85914	76844	66549	54337		
175	16	16	16	16	16	16	16	16	16	16	15	116020	109385	102320	94730	86476	77347	66984	54692		
176	16	16	16	16	16	16	16	16	16	16	16	116774	110096	102985	95346	87039	77850	67420	55048		
177	17	16	16	16	16	16	16	16	16	16	16	117538	110816	103659	95969	87608	78359	67861	55408		
178	17	17	16	16	16	16	16	16	16	16	16	118301	111536	104332	96593	88177	78868	68301	55768		
179	17	17	17	16	16	16	16	16	16	16	16	119065	112255	105005	97216	88746	79377	68742	56128		
180	17	17	17	17	16	16	16	16	16	16	16	119828	112975	105679	97839	89315	79886	69183	56488		
181	17	17	17	17	17	16	16	16	16	16	16	120592	113695	106352	98463	89884	80394	69624	56847		
182	17	17	17	17	17	17	16	16	16	16	16	121355	114415	107025	99086	90453	80903	70064	57207		
183	17	17	17	17	17	17	17	16	16	16	16	122119	115135	107699	99709	91022	81412	70505	57567		
184	17	17	17	17	17	17	17	17	16	16	16	122882	115854	108372	100333	91591	81921	70946	57927		
185	17	17	17	17	17	17	17	17	17	16	16	123646	116574	109045	100956	92160	82430	71387	58287		
186	17	17	17	17	17	17	17	17	17	17	16	124409	117294	109718	101580	92729	82939	71828	58647		
187	17	17	17	17	17	17	17	17	17	17	17	125172	118014	110392	102203	93298	83448	72268	59007		
188	18	17	17	17	17	17	17	17	17	17	17					93865	83955	72707	59365	41978	20989
189	18	18	17	17	17	17	17	17	17	17	17					94432	84462	73146	59724	42231	21116
190	18	18	18	17	17	17	17	17	17	17	17					94998	84969	73585	60082	42485	21242
191	18	18	18	18	17	17	17	17	17	17	17					95565	85476	74024	60441	42738	21369
192	18	18	18	18	18	17	17	17	17	17	17					96132	85983	74463	60799	42991	21496
193	18	18	18	18	18	18	17	17	17	17	17					96699	86490	74902	61158	43245	21622
194	18	18	18	18	18	18	18	17	17	17	17					97265	86997	75341	61516	43498	21749
195	18	18	18	18	18	18	18	18	17	17	17					97832	87504	75780	61874	43752	21876
196	18	18	18	18	18	18	18	18	18	17	17					98399	88011	76219	62233	44005	22003
197	18	18	18	18	18	18	18	18	18	18	17					98965	88517	76658	62591	44259	22129
198	18	18	18	18	18	18	18	18	18	18	18					99532	89024	77097	62950	44512	22256

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STEP NO.	GATE OPENING SCHEDULE GATE NUMBER											SPILLWAY DISCHARGE IN CFS GROSS HEAD					
	11	10	9	8	7	6	5	4	3	2	1	10.0	8.0	6.0	4.0	2.0	0.5
	OPENING IN RATCHET STEPS																
199	19	18	18	18	18	18	18	18	18	18	18	100068	89503	77512	63289	44752	22376
200	19	19	18	18	18	18	18	18	18	18	18	100604	89983	77927	63627	44991	22496
201	19	19	19	18	18	18	18	18	18	18	18	101139	90462	78342	63966	45231	22615
202	19	19	19	19	18	18	18	18	18	18	18	101675	90941	78757	64305	45470	22735
203	19	19	19	19	19	18	18	18	18	18	18	102211	91420	79172	64644	45710	22855
204	19	19	19	19	19	19	18	18	18	18	18	102746	91899	79587	64983	45950	22975
205	19	19	19	19	19	19	19	18	18	18	18	103282	92378	80002	65321	46189	23095
206	19	19	19	19	19	19	19	19	18	18	18	103818	92858	80417	65660	46429	23214
207	19	19	19	19	19	19	19	19	19	18	18	104354	93337	80832	65999	46668	23334
208	19	19	19	19	19	19	19	19	19	19	18	104889	93816	81247	66338	46908	23454
209	19	19	19	19	19	19	19	19	19	19	19	105425	94295	81662	66677	47147	23574
210	20	19	19	19	19	19	19	19	19	19	19	106054	94857	82149	67074	47429	23714
211	20	20	19	19	19	19	19	19	19	19	19	106683	95420	82636	67472	47710	23855
212	20	20	20	19	19	19	19	19	19	19	19	107311	95982	83123	67870	47991	23996
213	20	20	20	20	19	19	19	19	19	19	19	107940	96545	83610	68267	48272	24136
214	20	20	20	20	20	19	19	19	19	19	19	108569	97107	84097	68665	48554	24277
215	20	20	20	20	20	20	19	19	19	19	19	109198	97670	84584	69063	48835	24417
216	20	20	20	20	20	20	20	19	19	19	19	109827	98232	85071	69461	49116	24558
217	20	20	20	20	20	20	20	20	19	19	19	110456	98794	85559	69858	49397	24699
218	20	20	20	20	20	20	20	20	20	19	19	111084	99357	86046	70256	49678	24839
219	20	20	20	20	20	20	20	20	20	20	19	111713	99919	86533	70654	49960	24980
220	20	20	20	20	20	20	20	20	20	20	20	112342	100482	87020	71051	50241	25120
221	21	20	20	20	20	20	20	20	20	20	20	112931	101008	87476	71424	50504	25252
222	21	21	20	20	20	20	20	20	20	20	20	113519	101535	87932	71796	50767	25384
223	21	21	21	20	20	20	20	20	20	20	20	114108	102061	88388	72168	51031	25515
224	21	21	21	21	20	20	20	20	20	20	20	114696	102588	88843	72540	51294	25647
225	21	21	21	21	21	20	20	20	20	20	20	115285	103114	89299	72913	51557	25779
226	21	21	21	21	21	21	20	20	20	20	20	115874	103640	89755	73285	51820	25910
227	21	21	21	21	21	21	21	20	20	20	20	116462	104167	90211	73657	52083	26042
228	21	21	21	21	21	21	21	21	20	20	20	117051	104693	90667	74029	52347	26173
229	21	21	21	21	21	21	21	21	21	20	20	117639	105220	91123	74402	52610	26305
230	21	21	21	21	21	21	21	21	21	21	20	118228	105746	91579	74774	52873	26437
231	21	21	21	21	21	21	21	21	21	21	21	118817	106273	92035	75146	53136	26568
232	22	21	21	21	21	21	21	21	21	21	21	119412	106805	92496	75523	53403	26701
233	22	22	21	21	21	21	21	21	21	21	21	120007	107338	92957	75899	53669	26834
234	22	22	22	21	21	21	21	21	21	21	21	120603	107871	93419	76276	53935	26968
235	22	22	22	22	21	21	21	21	21	21	21	121198	108403	93880	76653	54202	27101
236	22	22	22	22	22	21	21	21	21	21	21	121794	108936	94341	77029	54468	27234
237	22	22	22	22	22	22	21	21	21	21	21	122389	109468	94802	77406	54734	27367
238	22	22	22	22	22	22	22	21	21	21	21	122985	110001	95264	77782	55001	27500
239	22	22	22	22	22	22	22	22	21	21	21	123580	110534	95725	78159	55267	27633
240	22	22	22	22	22	22	22	22	22	21	21	124176	111066	96186	78536	55533	27767
241	22	22	22	22	22	22	22	22	22	22	21	124771	111599	96647	78912	55799	27900
242	22	22	22	22	22	22	22	22	22	22	22	125367	112132	97109	79289	56066	28033

STEP NO.	GATE OPENING SCHEDULE GATE NUMBER											SPILLWAY DISCHARGE IN CFS GROSS HEAD					
	11	10	9	8	7	6	5	4	3	2	1	10.0	8.0	6.0	4.0	2.0	0.5
	OPENING IN RATCHET STEPS																
243	23	22	22	22	22	22	22	22	22	22	22	125970	112671	97576	79671	56336	28168
244	23	23	22	22	22	22	22	22	22	22	22	126574	113211	98044	80052	56606	28303
245	23	23	23	22	22	22	22	22	22	22	22	127177	113751	98511	80434	56875	28438
246	23	23	23	23	22	22	22	22	22	22	22	127781	114291	98979	80816	57145	28573
247	23	23	23	23	23	22	22	22	22	22	22	128385	114831	99446	81197	57415	28708
248	23	23	23	23	23	23	22	22	22	22	22	128988	115370	99914	81579	57685	28843
249	23	23	23	23	23	23	23	22	22	22	22	129592	115910	100381	81961	57955	28978
250	23	23	23	23	23	23	23	23	22	22	22	130195	116450	100849	82343	58225	29113
251	23	23	23	23	23	23	23	23	23	22	22	130799	116990	101316	82724	58495	29247
252	23	23	23	23	23	23	23	23	23	23	22	131402	117530	101784	83106	58765	29382
253	23	23	23	23	23	23	23	23	23	23	23	132006	118069	102251	83488	59035	29517
254	24	23	23	23	23	23	23	23	23	23	23	132617	118617	102725	83875	59308	29654
255	24	24	23	23	23	23	23	23	23	23	23	133229	119164	103199	84261	59582	29791
256	24	24	24	23	23	23	23	23	23	23	23	133840	119711	103672	84648	59855	29928
257	24	24	24	24	23	23	23	23	23	23	23	134452	120258	104146	85035	60129	30064
258	24	24	24	24	24	23	23	23	23	23	23	135064	120805	104620	85422	60402	30201
259	24	24	24	24	24	24	23	23	23	23	23	135675	121352	105094	85809	60676	30338
260	24	24	24	24	24	24	24	23	23	23	23	136287	121899	105567	86195	60949	30475
261	24	24	24	24	24	24	24	24	23	23	23	136898	122446	106041	86582	61223	30611
262	24	24	24	24	24	24	24	24	24	23	23	137510	122993	106515	86969	61496	30748
263	24	24	24	24	24	24	24	24	24	24	23	138122	123540	106988	87356	61770	30885
264	24	24	24	24	24	24	24	24	24	24	24	138733	124087	107462	87743	62043	31022
265	25	24	24	24	24	24	24	24	24	24	24	139358	124646	107947	88138	62323	31161
266	25	25	24	24	24	24	24	24	24	24	24	139984	125205	108431	88534	62603	31301
267	25	25	25	24	24	24	24	24	24	24	24	140609	125765	108915	88929	62882	31441
268	25	25	25	25	24	24	24	24	24	24	24	141235	126324	109400	89325	63162	31581
269	25	25	25	25	25	24	24	24	24	24	24	141860	126883	109884	89720	63442	31721
270	25	25	25	25	25	25	24	24	24	24	24	142485	127443	110369	90116	63721	31861
271	25	25	25	25	25	25	25	24	24	24	24	143111	128002	110853	90511	64001	32001
272	25	25	25	25	25	25	25	25	24	24	24	143736	128561	111337	90907	64281	32140
273	25	25	25	25	25	25	25	25	25	24	24	144361	129121	111822	91302	64560	32280
274	25	25	25	25	25	25	25	25	25	25	24	144987	129680	112306	91698	64840	32420
275	25	25	25	25	25	25	25	25	25	25	25	145612	130240	112791	92093	65120	32560
276	26	25	25	25	25	25	25	25	25	25	25	146240	130801	113277	92490	65400	32700
277	26	26	25	25	25	25	25	25	25	25	25	146868	131362	113763	92887	65681	32841
278	26	26	26	25	25	25	25	25	25	25	25	147495	131924	114249	93284	65962	32981
279	26	26	26	26	25	25	25	25	25	25	25	148123	132485	114736	93681	66243	33121
280	26	26	26	26	26	25	25	25	25	25	25	148751	133047	115222	94078	66523	33262
281	26	26	26	26	26	26	25	25	25	25	25	149378	133608	115708	94475	66804	33402
282	26	26	26	26	26	26	26	25	25	25	25	150006	134169	116194	94872	67085	33542
283	26	26	26	26	26	26	26	26	25	25	25	150634	134731	116680	95269	67365	33683
284	26	26	26	26	26	26	26	26	26	25	25	151261	135292	117166	95666	67646	33823
285	26	26	26	26	26	26	26	26	26	26	25	151889	135854	117653	96063	67927	33963
286	26	26	26	26	26	26	26	26	26	26	26	152517	136415	118139	96460	68208	34104

ALABAMA-COOSA BASIN
WATER CONTROL MANUAL
ROBERT F. HENRY LOCK AND DAM
ALABAMA RIVER, ALABAMA
SPILLWAY GATE OPERATION SCHEDULE

CORPS OF ENGINEERS

U. S. ARMY

STEP NO.	GATE OPENING SCHEDULE GATE NUMBER											SPILLWAY DISCHARGE IN CFS GROSS HEAD					
	11	10	9	8	7	6	5	4	3	2	1	10.0	8.0	6.0	4.0	2.0	0.5
	OPENING IN RATCHET STEPS																
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288	27	27	26	26	26	26	26	26	26	26	26	153793	137556	119127	97267	68778	34389
289	27	27	27	26	26	26	26	26	26	26	26	154431	138127	119621	97671	69063	34532
290	27	27	27	27	26	26	26	26	26	26	26	155069	138698	120116	98074	69349	34674
291	27	27	27	27	27	26	26	26	26	26	26	155707	139268	120610	98478	69634	34817
292	27	27	27	27	27	27	26	26	26	26	26	156345	139839	121104	98881	69919	34960
293	27	27	27	27	27	27	27	26	26	26	26	156983	140410	121598	99285	70205	35102
294	27	27	27	27	27	27	27	27	26	26	26	157621	140980	122093	99688	70490	35245
295	27	27	27	27	27	27	27	27	27	26	26	158259	141551	122587	100092	70775	35388
296	27	27	27	27	27	27	27	27	27	27	26	158897	142122	123081	100495	71061	35530
297	27	27	27	27	27	27	27	27	27	27	27	159535	142692	123575	100899	71346	35673
298	28	27	27	27	27	27	27	27	27	27	27	160179	143268	124074	101306	71634	35817
299	28	28	27	27	27	27	27	27	27	27	27	160822	143844	124572	101713	71922	35961
300	28	28	28	27	27	27	27	27	27	27	27	161466	144420	125071	102120	72210	36105
301	28	28	28	28	27	27	27	27	27	27	27	162110	144995	125570	102527	72498	36249
302	28	28	28	28	28	27	27	27	27	27	27	162754	145571	126068	102934	72786	36393
303	28	28	28	28	28	28	27	27	27	27	27	163397	146147	126567	103342	73074	36537
304	28	28	28	28	28	28	28	27	27	27	27	164041	146723	127066	103749	73361	36681
305	28	28	28	28	28	28	28	28	27	27	27	164685	147299	127564	104156	73649	36825
306	28	28	28	28	28	28	28	28	28	27	27	165329	147875	128063	104563	73937	36969
307	28	28	28	28	28	28	28	28	28	28	27	165973	148450	128562	104970	74225	37113
308	28	28	28	28	28	28	28	28	28	28	28	166616	149026	129060	105377	74513	37257
309	29	28	28	28	28	28	28	28	28	28	28	167260	149602	129559	105785	74801	37400
310	29	29	28	28	28	28	28	28	28	28	28	167904	150178	130058	106192	75089	37544
311	29	29	29	28	28	28	28	28	28	28	28	168548	150754	130556	106599	75377	37688
312	29	29	29	29	28	28	28	28	28	28	28	169191	151329	131055	107006	75665	37832
313	29	29	29	29	29	28	28	28	28	28	28	169835	151905	131554	107413	75953	37976
314	29	29	29	29	29	29	28	28	28	28	28	170479	152481	132052	107820	76240	38120
315	29	29	29	29	29	29	29	28	28	28	28	171123	153057	132551	108227	76528	38264
316	29	29	29	29	29	29	29	29	28	28	28	171766	153633	133050	108635	76816	38408
317	29	29	29	29	29	29	29	29	29	28	28	172410	154208	133548	109042	77104	38552
318	29	29	29	29	29	29	29	29	29	29	28	173054	154784	134047	109449	77392	38696
319	29	29	29	29	29	29	29	29	29	29	29	173698	155360	134546	109856	77680	38840
320	30	29	29	29	29	29	29	29	29	29	29	174350	155943	135051	110268	77971	38986
321	30	30	29	29	29	29	29	29	29	29	29	175001	156526	135555	110681	78263	39131
322	30	30	30	29	29	29	29	29	29	29	29	175653	157109	136060	111093	78554	39277
323	30	30	30	30	29	29	29	29	29	29	29	176305	157692	136565	111505	78846	39423
324	30	30	30	30	30	29	29	29	29	29	29	176957	158275	137070	111917	79137	39569
325	30	30	30	30	30	30	29	29	29	29	29	177609	158858	137575	112330	79429	39714
326	30	30	30	30	30	30	30	29	29	29	29	178260	159441	138080	112742	79720	39860
327	30	30	30	30	30	30	30	30	29	29	29	178912	160024	138585	113154	80012	40006
328	30	30	30	30	30	30	30	30	30	29	29	179564	160607	139090	113566	80303	40152
329	30	30	30	30	30	30	30	30	30	30	29	180216	161190	139595	113979	80595	40297
330	30	30	30	30	30	30	30	30	30	30	30	180868	161773	140099	114391	80886	40443

STEP NO.	GATE OPENING SCHEDULE GATE NUMBER											SPILLWAY DISCHARGE IN CFS GROSS HEAD					
	11	10	9	8	7	6	5	4	3	2	1	10.0	8.0	6.0	4.0	2.0	0.5
	OPENING IN RATCHET STEPS																
331	31	30	30	30	30	30	30	30	30	30	30	181519	162356	140604	114803	81178	40589
332	31	31	30	30	30	30	30	30	30	30	30	182171	162939	141109	115215	81469	40735
333	31	31	31	30	30	30	30	30	30	30	30	182823	163522	141614	115627	81761	40880
334	31	31	31	31	30	30	30	30	30	30	30	183475	164105	142119	116040	82052	41026
335	31	31	31	31	31	30	30	30	30	30	30	184127	164688	142624	116452	82344	41172
336	31	31	31	31	31	31	30	30	30	30	30	184779	165271	143129	116864	82635	41318
337	31	31	31	31	31	31	31	30	30	30	30	185430	165854	143634	117276	82927	41463
338	31	31	31	31	31	31	31	31	30	30	30	186082	166437	144139	117689	83218	41609
339	31	31	31	31	31	31	31	31	31	30	30	186734	167020	144644	118101	83510	41755
340	31	31	31	31	31	31	31	31	31	31	30	187386	167603	145148	118513	83801	41901
341	31	31	31	31	31	31	31	31	31	31	31	188038	168186	145653	118925	84093	42046
342	32	31	31	31	31	31	31	31	31	31	31	188696	168775	146164	119342	84388	42194
343	32	32	31	31	31	31	31	31	31	31	31	189355	169364	146674	119759	84682	42341
344	32	32	32	31	31	31	31	31	31	31	31	190014	169953	147184	120175	84977	42488
345	32	32	32	32	31	31	31	31	31	31	31	190672	170543	147694	120592	85271	42636
346	32	32	32	32	32	31	31	31	31	31	31	191331	171132	148205	121008	85566	42783
347	32	32	32	32	32	32	31	31	31	31	31	191990	171721	148715	121425	85860	42930
348	32	32	32	32	32	32	32	31	31	31	31	192649	172310	149225	121842	86155	43078
349	32	32	32	32	32	32	32	32	31	31	31	193307	172899	149735	122258	86450	43225
350	32	32	32	32	32	32	32	32	32	31	31	193966	173489	150245	122675	86744	43372
351	32	32	32	32	32	32	32	32	32	32	31	194625	174078	150756	123092	87039	43519
352	32	32	32	32	32	32	32	32	32	32	32	195283	174667	151266	123508	87333	43667
353	33	32	32	32	32	32	32	32	32	32	32	195949	175262	151782	123929	87631	43816
354	33	33	32	32	32	32	32	32	32	32	32	196615	175858	152297	124350	87929	43964
355	33	33	33	32	32	32	32	32	32	32	32	197280	176453	152813	124771	88226	44113
356	33	33	33	33	32	32	32	32	32	32	32	197946	177048	153328	125192	88524	44262
357	33	33	33	33	33	32	32	32	32	32	32	198612	177644	153844	125613	88822	44411
358	33	33	33	33	33	33	32	32	32	32	32	199277	178239	154359	126034	89119	44560
359	33	33	33	33	33	33	33	32	32	32	32	199943	178834	154875	126455	89417	44709
360	33	33	33	33	33	33	33	33	32	32	32	200608	179430	155391	126876	89715	44857
361	33	33	33	33	33	33	33	33	33	32	32	201274	180025	155906	127297	90012	45006
362	33	33	33	33	33	33	33	33	33	33	32	201940	180620	156422	127718	90310	45155
363	33	33	33	33	33	33	33	33	33	33	33	202605	181216	156937	128139	90608	45304
364	34	33	33	33	33	33	33	33	33	33	33	203257	181799	157442	128551	90899	45450
365	34	34	33	33	33	33	33	33	33	33	33	203909	182382	157947	128963	91191	45595
366	34	34	34	33	33	33	33	33	33	33	33	204561	182965	158452	129375	91482	45741
367	34	34	34	34	33	33	33	33	33	33	33	205212	183548	158957	129788	91774	45887
368	34	34	34	34	34	33	33	33	33	33	33	205864	184131	159462	130200	92065	46033
369	34	34	34	34	34	34	33	33	33	33	33	206516	184714	159967	130612	92357	46178
370	34	34	34	34	34	34	34	33	33	33	33	207168	185297	160472	131024	92648	46324
371	34	34	34	34	34	34	34	34	33	33	33	207820	185880	160976	131437	92940	46470
372	34	34	34	34	34	34	34	34	34	33	33	208472	186463	161481	131849	93231	46616
373	34	34	34	34	34	34	34	34	34	34	33	209123	187046	161986	132261	93523	46761
374	34	34	34	34	34	34	34	34	34	34	34	209775	187629	162491	132673	93814	46907

ALABAMA-COOSA BASIN

WATER CONTROL MANUAL

ROBERT F. HENRY LOCK AND DAM

ALABAMA RIVER, ALABAMA

SPILLWAY GATE OPERATION SCHEDULE

STEP NO.	GATE OPENING SCHEDULE GATE NUMBER											SPILLWAY DISCHARGE IN CFS GROSS HEAD					
	11	10	9	8	7	6	5	4	3	2	1	10.0	8.0	6.0	4.0	2.0	0.5
	OPENING IN RATCHET STEPS																
375	35	34	34	34	34	34	34	34	34	34	34	210453	188235	163017	133102	94118	47059
376	35	35	34	34	34	34	34	34	34	34	34	211132	188842	163542	133531	94421	47210
377	35	35	35	34	34	34	34	34	34	34	34	211810	189449	164067	133960	94724	47362
378	35	35	35	35	34	34	34	34	34	34	34	212488	190055	164593	134389	95028	47514
379	35	35	35	35	35	34	34	34	34	34	34	213166	190662	165118	134818	95331	47665
380	35	35	35	35	35	35	34	34	34	34	34	213845	191268	165643	135247	95634	47817
381	35	35	35	35	35	35	35	34	34	34	34	214523	191875	166169	135676	95938	47969
382	35	35	35	35	35	35	35	35	34	34	34	215201	192482	166694	136105	96241	48120
383	35	35	35	35	35	35	35	35	35	34	34	215879	193088	167219	136534	96544	48272
384	35	35	35	35	35	35	35	35	35	35	34	216558	193695	167745	136963	96848	48424
385	35	35	35	35	35	35	35	35	35	35	35	217236	194302	168270	137392	97151	48575
386	36	35	35	35	35	35	35	35	35	35	35	217918	194911	168798	137823	97456	48728
387	36	36	35	35	35	35	35	35	35	35	35	218599	195521	169326	138254	97761	48880
388	36	36	36	35	35	35	35	35	35	35	35	219281	196131	169854	138686	98065	49033
389	36	36	36	36	35	35	35	35	35	35	35	219963	196741	170382	139117	98370	49185
390	36	36	36	36	36	35	35	35	35	35	35	220644	197350	170910	139548	98675	49338
391	36	36	36	36	36	36	35	35	35	35	35	221326	197960	171439	139979	98980	49490
392	36	36	36	36	36	36	36	35	35	35	35	222008	198570	171967	140410	99285	49642
393	36	36	36	36	36	36	36	36	35	35	35	222690	199180	172495	140841	99590	49795
394	36	36	36	36	36	36	36	36	36	35	35	223371	199789	173023	141272	99895	49947
395	36	36	36	36	36	36	36	36	36	36	35	224053	200399	173551	141704	100200	50100
396	36	36	36	36	36	36	36	36	36	36	36	224735	201009	174079	142135	100504	50252
397	37	36	36	36	36	36	36	36	36	36	36	225419	201621	174609	142567	100810	50405
398	37	37	36	36	36	36	36	36	36	36	36	226103	202232	175138	143000	101116	50558
399	37	37	37	36	36	36	36	36	36	36	36	226787	202844	175668	143433	101422	50711
400	37	37	37	37	36	36	36	36	36	36	36	227471	203456	176198	143865	101728	50864
401	37	37	37	37	37	36	36	36	36	36	36	228155	204068	176728	144298	102034	51017
402	37	37	37	37	37	37	36	36	36	36	36	228839	204680	177258	144730	102340	51170
403	37	37	37	37	37	37	37	36	36	36	36	229523	205291	177788	145163	102646	51323
404	37	37	37	37	37	37	37	37	36	36	36	230207	205903	178317	145596	102952	51476
405	37	37	37	37	37	37	37	37	37	36	36	230891	206515	178847	146028	103257	51629
406	37	37	37	37	37	37	37	37	37	37	36	231575	207127	179377	146461	103563	51782
407	37	37	37	37	37	37	37	37	37	37	37	232259	207739	179907	146893	103869	51935
408	38	37	37	37	37	37	37	37	37	37	37	232958	208364	180448	147335	104182	52091
409	38	38	37	37	37	37	37	37	37	37	37	233657	208989	180990	147777	104494	52247
410	38	38	38	37	37	37	37	37	37	37	37	234356	209614	181531	148219	104807	52403
411	38	38	38	38	37	37	37	37	37	37	37	235055	210239	182072	148662	105120	52560
412	38	38	38	38	38	37	37	37	37	37	37	235753	210864	182614	149104	105432	52716
413	38	38	38	38	38	38	37	37	37	37	37	236452	211489	183155	149546	105745	52872
414	38	38	38	38	38	38	38	37	37	37	37	237151	212115	183697	149988	106057	53029
415	38	38	38	38	38	38	38	38	37	37	37	237850	212740	184238	150430	106370	53185
416	38	38	38	38	38	38	38	38	38	37	37	238549	213365	184779	150872	106682	53341
417	38	38	38	38	38	38	38	38	38	38	37	239248	213990	185321	151314	106995	53498
418	38	38	38	38	38	38	38	38	38	38	38	239947	214615	185862	151756	107308	53654

STEP NO.	GATE OPENING SCHEDULE GATE NUMBER											SPILLWAY DISCHARGE IN CFS GROSS HEAD					
	11	10	9	8	7	6	5	4	3	2	1	10.0	8.0	6.0	4.0	2.0	0.5
	OPENING IN RATCHET STEPS																
419	39	38	38	38	38	38	38	38	38	38	38	240653	215247	186409	152202	107623	53812
420	39	39	38	38	38	38	38	38	38	38	38	241359	215878	186956	152649	107939	53969
421	39	39	39	38	38	38	38	38	38	38	38	242065	216509	187503	153095	108255	54127
422	39	39	39	39	38	38	38	38	38	38	38	242771	217141	188049	153542	108570	54285
423	39	39	39	39	39	38	38	38	38	38	38	243476	217772	188596	153988	108886	54443
424	39	39	39	39	39	39	38	38	38	38	38	244182	218403	189143	154434	109202	54601
425	39	39	39	39	39	39	39	38	38	38	38	244888	219035	189689	154881	109517	54759
426	39	39	39	39	39	39	39	39	38	38	38	245594	219666	190236	155327	109833	54916
427	39	39	39	39	39	39	39	39	39	38	38	246300	220297	190783	155774	110149	55074
428	39	39	39	39	39	39	39	39	39	39	38	247006	220929	191330	156220	110464	55232
429	39	39	39	39	39	39	39	39	39	39	39	247711	221560	191876	156666	110780	55390
430	40	39	39	39	39	39	39	39	39	39	39	248417	222191	192423	157113	111096	55548
431	40	40	39	39	39	39	39	39	39	39	39	249123	222823	192970	157559	111411	55706
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433	40	40	40	40	39	39	39	39	39	39	39	250535	224085	194063	158452	112043	56021
434	40	40	40	40	40	39	39	39	39	39	39	251241	224716	194610	158899	112358	56179
435	40	40	40	40	40	40	39	39	39	39	39	251947	225348	195157	159345	112674	56337
436	40	40	40	40	40	40	40	39	39	39	39	252652	225979	195704	159791	112990	56495
437	40	40	40	40	40	40	40	40	39	39	39	253358	226610	196250	160238	113305	56653
438	40	40	40	40	40	40	40	40	40	39	39	254064	227242	196797	160684	113621	56810
439	40	40	40	40	40	40	40	40	40	40	39	254770	227873	197344	161131	113937	56968
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441	41	40	40	40	40	40	40	40	40	40	40	256182	229136	198437	162023	114568	57284
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450	41	41	41	41	41	41	41	41	41	41	40	262534	234818	203358	166041	117409	58704
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452	42	41	41	41	41	41	41	41	41	41	41	263968	236100	204469	166948	118050	59025
453	42	42	41	41	41	41	41	41	41	41	41	264695	236751	205032	167408	118375	59188
454	42	42	42	41	41	41	41	41	41	41	41	265423	237402	205596	167868	118701	59350
455	42	42	42	42	41	41	41	41	41	41	41	266151	238053	206160	168329	119026	59513
456	42	42	42	42	42	41	41	41	41	41	41	266878	238703	206723	168789	119352	59676
457	42	42	42	42	42	42	41	41	41	41	41	267606	239354	207287	169249	119677	59839
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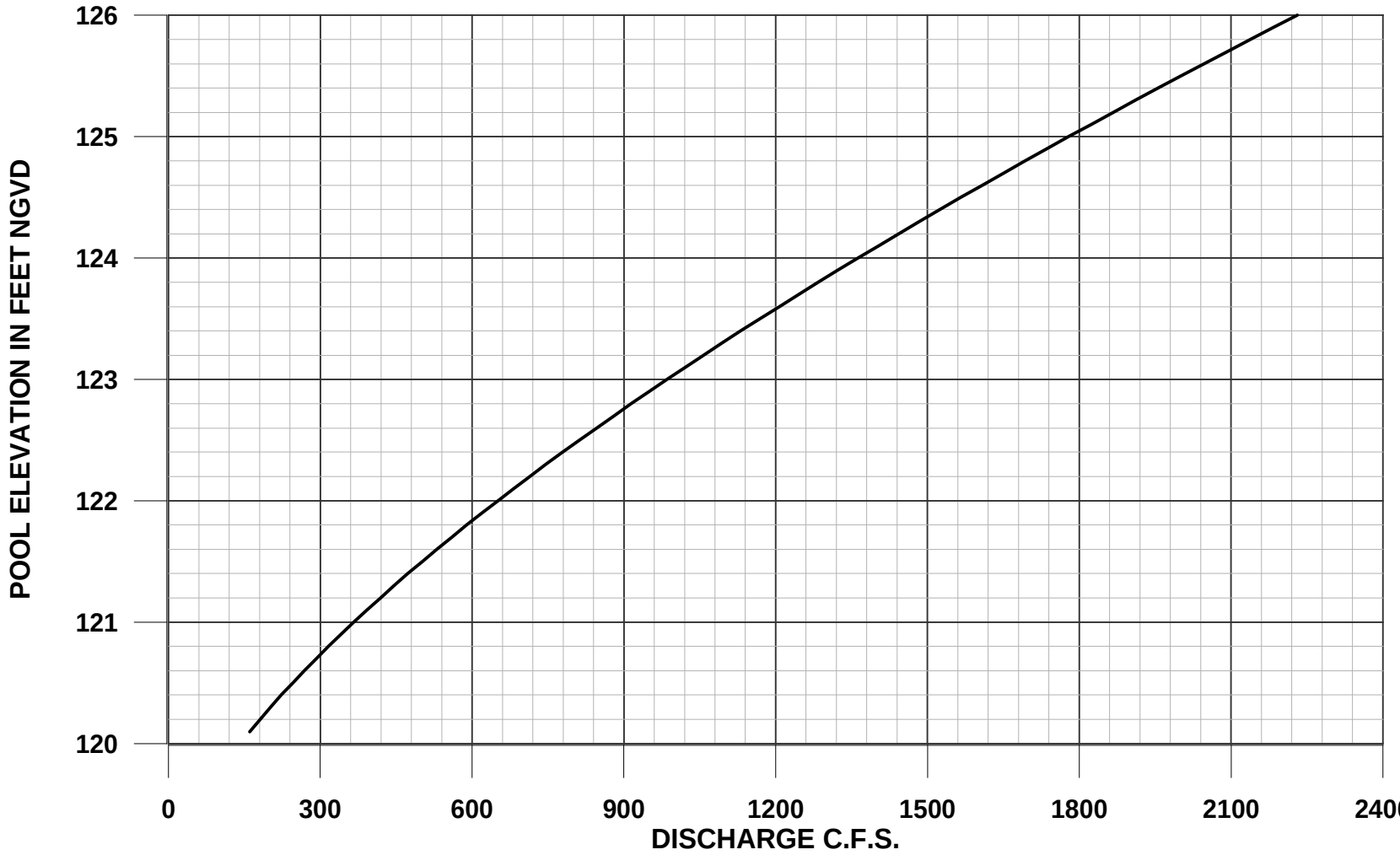
461	42	42	42	42	42	42	42	42	42	42	41	270517	241958	209542	171090	120979	60489
462	42	42	42	42	42	42	42	42	42	42	42	271245	242609	210105	171550	121304	60652

ALABAMA-COOSA BASIN
WATER CONTROL MANUAL
ROBERT F. HENRY LOCK AND DAM
ALABAMA RIVER, ALABAMA
SPILLWAY GATE OPERATION SCHEDULE



ALABAMA-COOSA BASIN
WATER CONTROL MANUAL

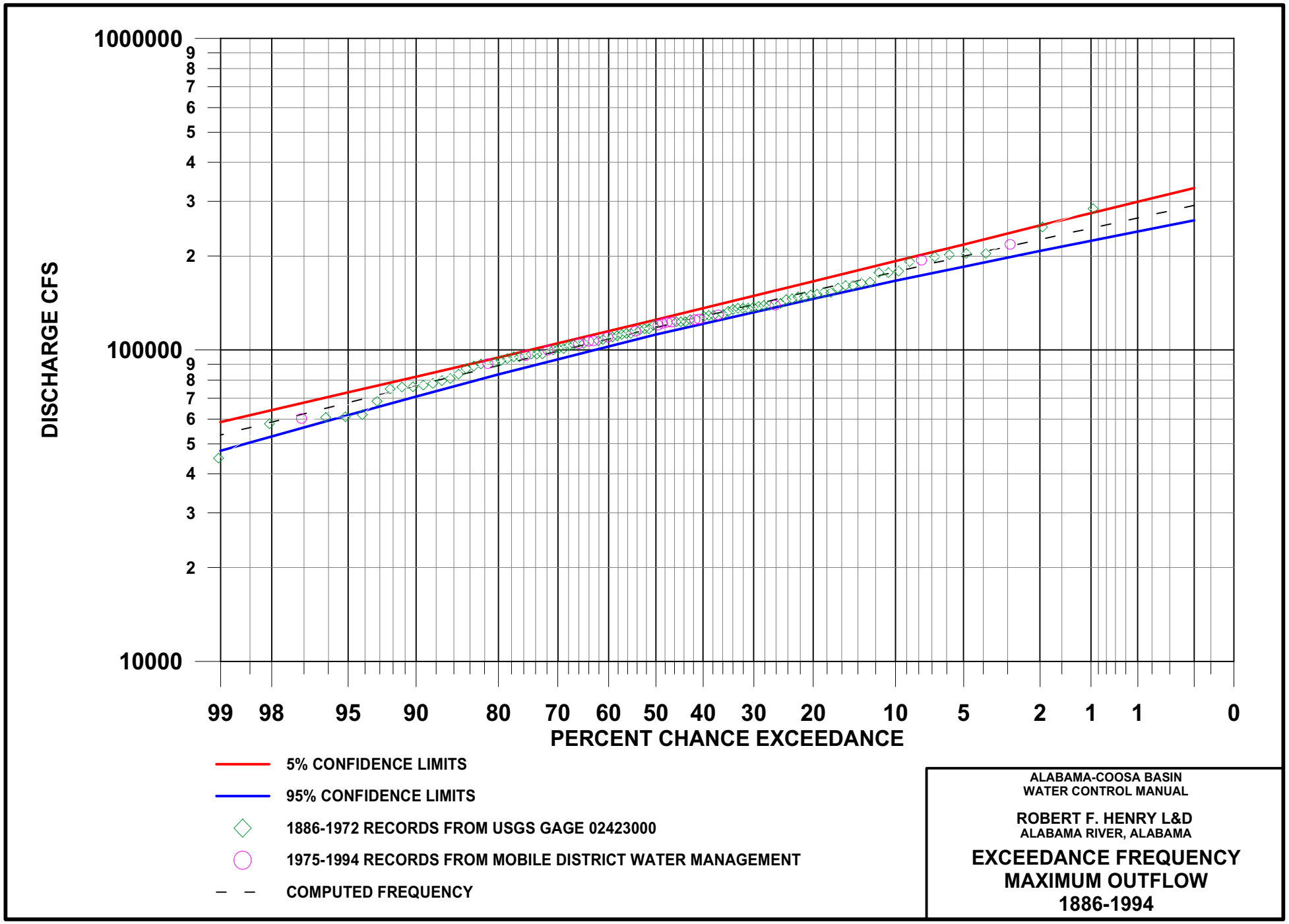
ROBERT F. HENRY LOCK AND DAM
ALABAMA RIVER, ALABAMA

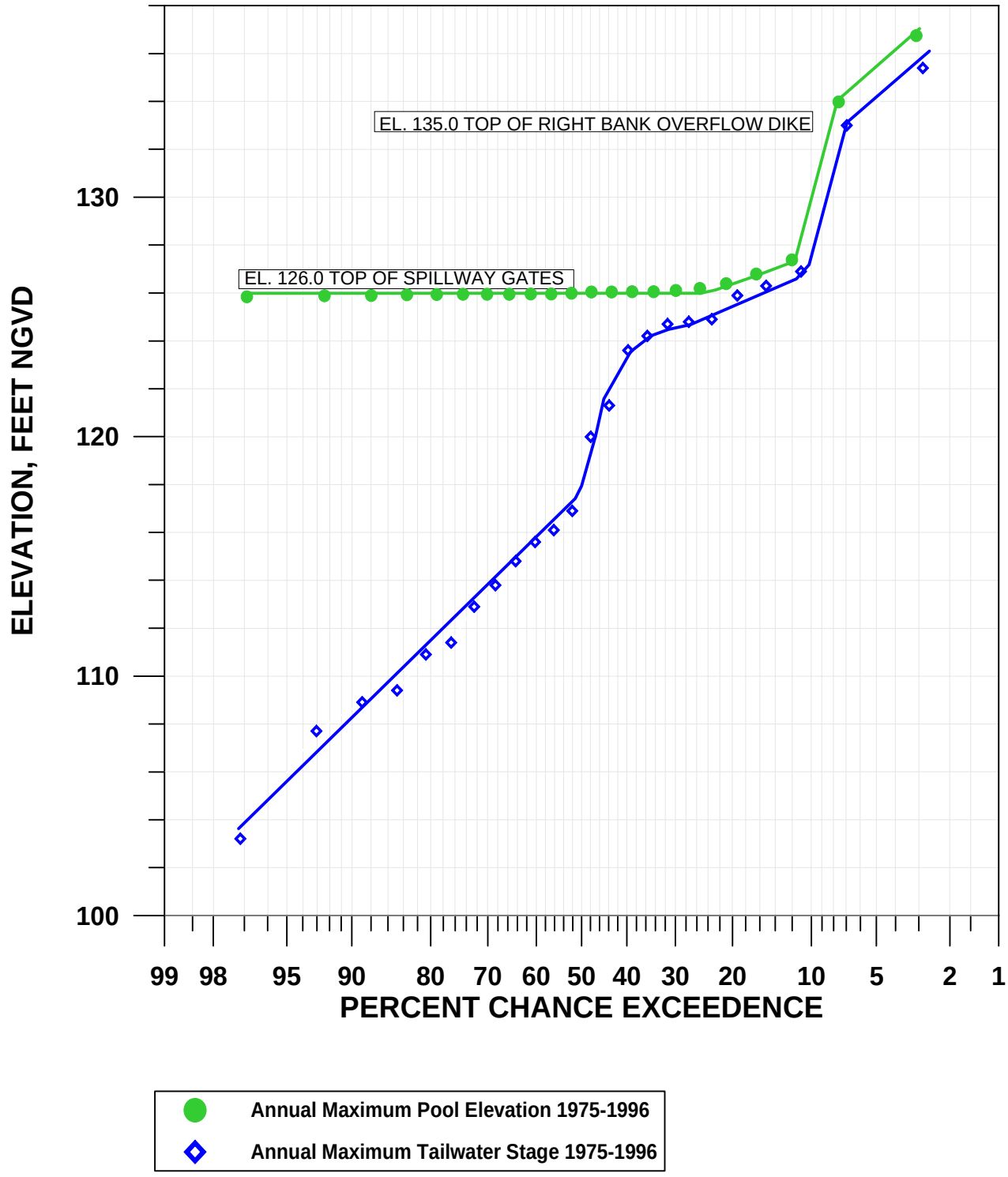
TRASHGATE RATING CURVE

CORPS OF ENGINEERS

U.S. ARMY

APPENDIX G PLATE NO. 7-11


DISCHARGE CFS
1000000
9
8
7
6
5
4
3
2
100000
9
8
7
6
5
4
3
2
10000
99
98
95
90
80
70
60
50
40
30
20
10
5
2
1
1
0
PERCENT CHANCE EXCEEDANCE
5% CONFIDENCE LIMITS
95% CONFIDENCE LIMITS
1886-1972 RECORDS FROM USGS GAGE 02423000
1975-1994 RECORDS FROM MOBILE DISTRICT WATER MANAGEMENT
COMPUTED FREQUENCY
ALABAMA-COOSA BASIN
WATER CONTROL MANUAL
ROBERT F. HENRY L&D
ALABAMA RIVER, ALABAMA
EXCEEDANCE FREQUENCY
MAXIMUM OUTFLOW
1886-1994
CORPS OF ENGINEERS
U.S. ARMY
APPENDIX G PLATE NO. 8-1

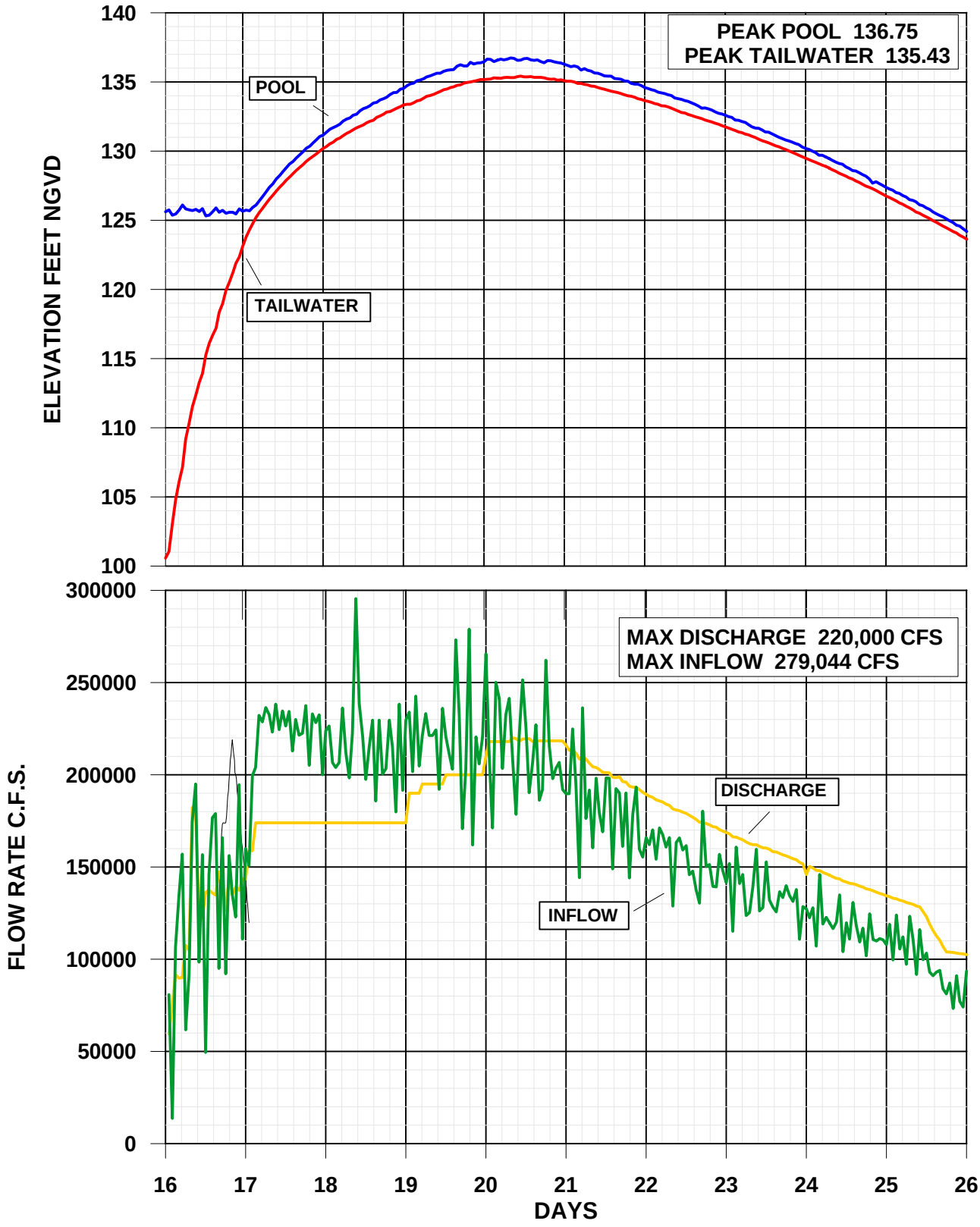


ALABAMA-COOSA RIVER BASIN
WATER CONTROL MANUAL

ROBERT F. HENRY LOCK AND DAM

ALABAMA RIVER, ALABAMA

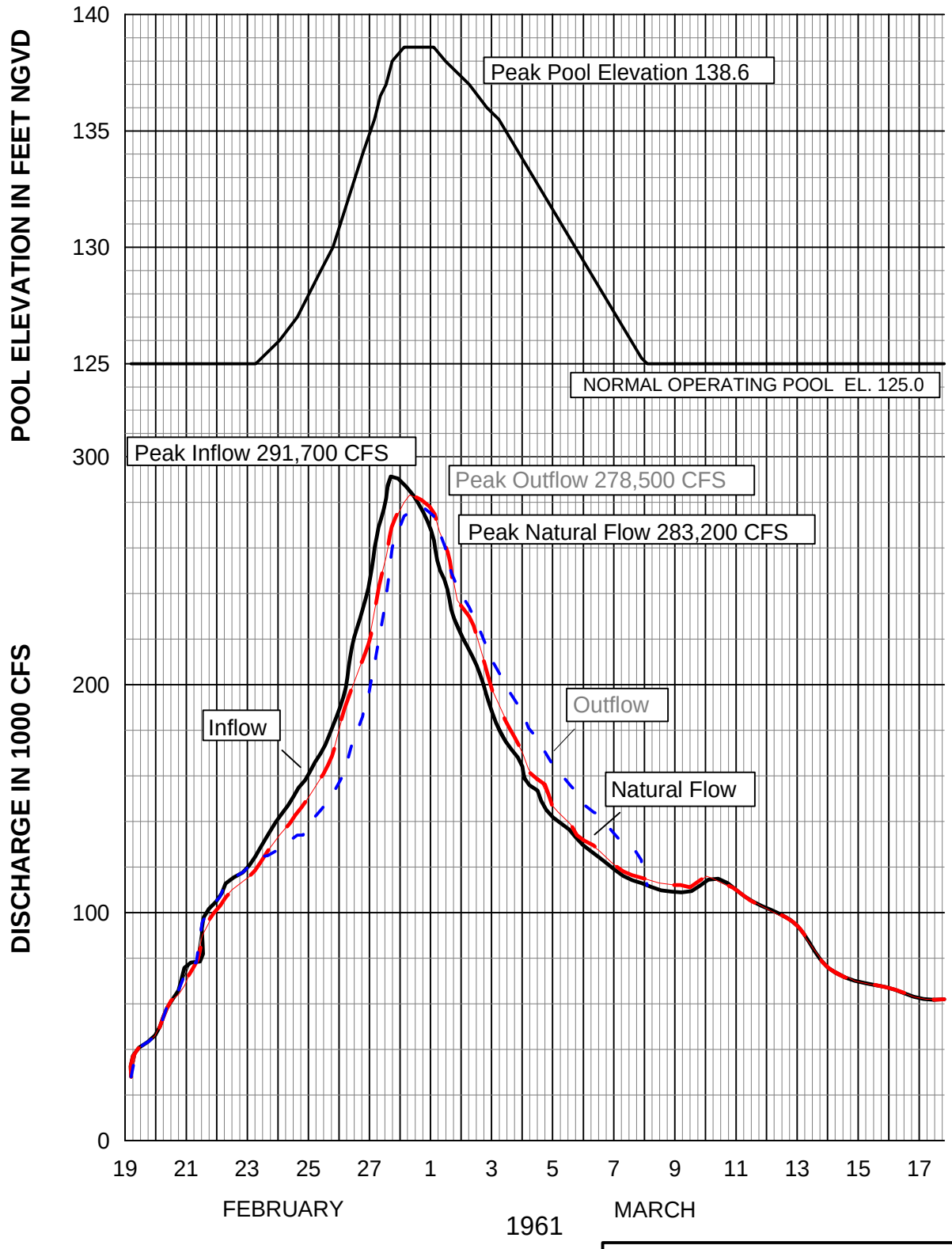
MAXIMUM POOL-TAILWATER ELEVATION FREQUENCY CURVE



ALABAMA-COOSA BASIN
WATER CONTROL MANUAL

ROBERT F. HENRY LOCK AND DAM
ALABAMA RIVER, ALABAMA

INFLOW OUTFLOW-POOL TAILWATER HYDROGRAPHS FOR FLOOD OF MARCH 1990



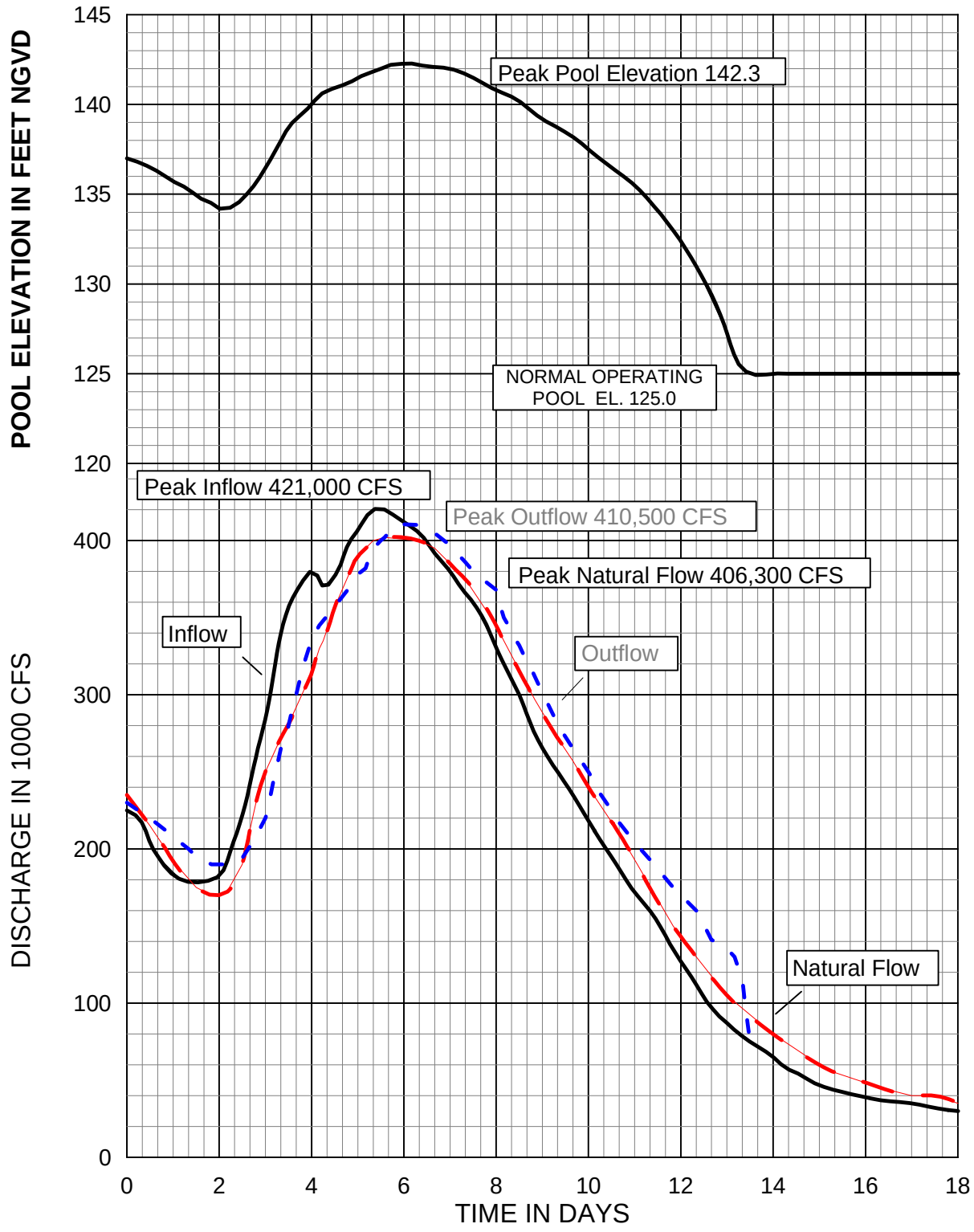
NOTES: Effect of proposed APC dams not considered.

ALABAMA - COOSA BASIN
WATER CONTROL MANUAL

ROBERT F. HENRY LOCK AND DAM

ALABAMA RIVER, ALABAMA

INFLOW-OUTFLOW-POOL STAGE HYDROGRAPHS FOR FLOOD OF FEB.-MAR. 1961



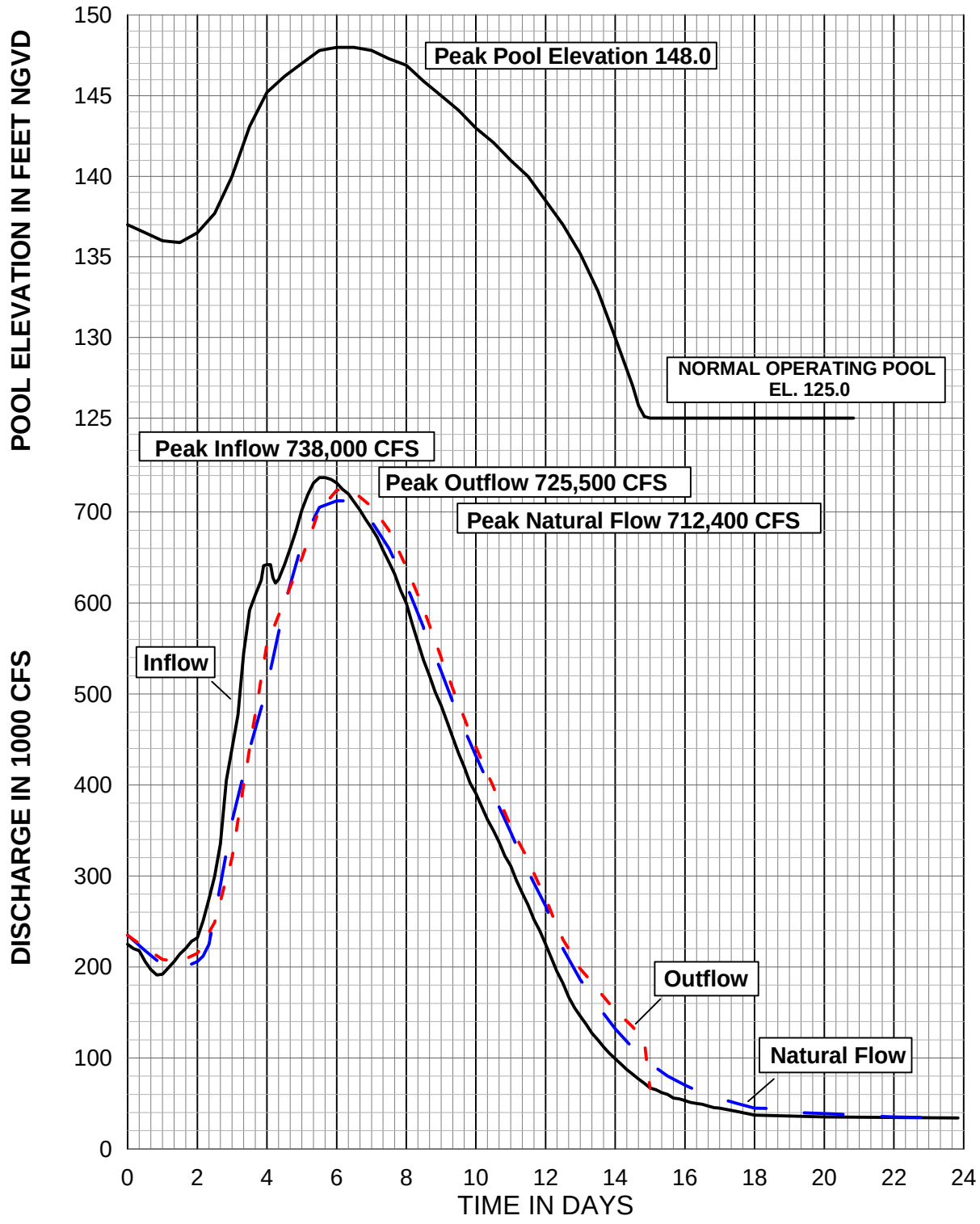
NOTES:
Standard project flood series- Flood of March 1929 followed by standard project flood. Hydrographs prior to beginning of standard project flood not shown.
Existing and proposed APC dams assumed in operation.

ALABAMA - COOSA BASIN
WATER CONTROL MANUAL

ROBERT F. HENRY LOCK AND DAM

ALABAMA RIVER, ALABAMA

INFLOW-OUTFLOW-POOL STAGE HYDROGRAPHS FOR STANDARD PROJECT FLOOD



NOTES:
Spillway design flood series- Flood of March 1929 followed by spillway design flood. Hydrographs prior to beginning of spillway design flood not shown.
Spillway- 11-50' x 35' Tainter Gates with crest at El. 91.0.
Existing and proposed APC dams assumed in operation.

ALABAMA - COOSA BASIN
WATER CONTROL MANUAL

ROBERT F. HENRY LOCK AND DAM
ALABAMA RIVER, ALABAMA

INFLOW-OUTFLOW-POOL STAGE HYDROGRAPHS FOR SPILLWAY DESIGN FLOOD